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NRL PROCESSOR-AIDED FIRE DETECTION SYSTEM. (U)
SEP 79 T T STREET , K D LAWRENCE
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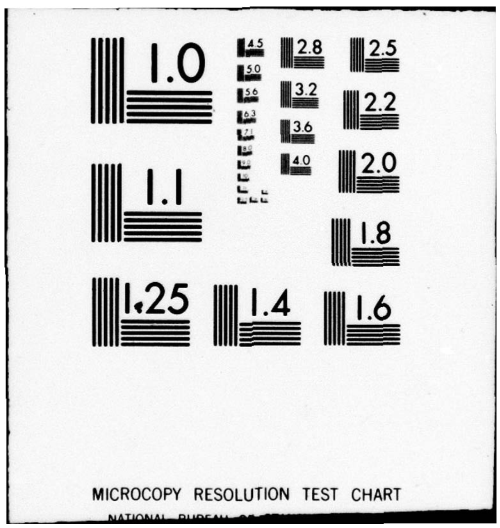

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NRL Report 8341

LEVEL II (12)

NRL Processor-Aided Fire Detection System

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F. W. WILLIAMS, AND J. I. ALEXANDER

Combustion and Fuels Branch
Chemistry Division

September 14, 1979

NAVAL RESEARCH LABORATORY
Washington, D.C.

ERRATUM

NRL Report 8341

All test run plots in Appendix B contain a typographical error. The Obscuration Full Scale unit in the figure legends should read mV instead of mW.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Detection	Logic
Environment	Processor aided
Fire	Reliability
Hostile	Smoke

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

→ A series of fire tests has been conducted simulating shipboard environments. During these tests an NRL prototype fire detection system was compared to two commercial fire detectors. The detectors were exposed to various fuel-type fires involving both solids and liquids, and to different humidity and temperature conditions. Comparative results for 100 experiments are presented. The reliability of the detectors is also examined. ←

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CONTENTS

NRL PROCESSOR-AIDED FIRE DETECTION SYSTEM

INTRODUCTION

Substantial advances have been made in early detection of hostile fires [1-3]. For the public in general this has meant the availability of commercial smoke and fire detection devices for the home and industry. If these devices are used, they have the potential of saving thousands of lives [4]. Most of the commercially available smoke and fire detectors are "static" detectors designed for the relatively stable environments found in the civilian sector. These detectors function by convective migration of particles of combustion into the detection chamber. Some have elaborate labyrinth designs to control the particle entry and exit from the sensing chambers.

Static smoke and fire detectors, when exposed to high and changing air-flow rates, changing temperature and humidity, and dirty environments, will *not function properly* [3-7]. Detectors under these extreme conditions will either false alarm or become incapable of giving an alarm. These hostile environmental parameters are typical of shipboard and some industrial conditions in which reliable detection must take place [1].

One way to help achieve reliable detection in extreme environments is to have a dynamic form of smoke and fire detection that is insensitive to fluctuating environments. Hostile environments generate environmental "noise" spikes which trigger false alarms. By averaging or smoothing the captured environment, sporadic excursions (environmental noise) can be eliminated.

Detector reliability and stability are areas which also need attention. Smoke and fire detection systems must alarm reliably to products of combustion after prolonged operation in dirty environments.

A prototype fire detection system has been developed at NRL to greatly reduce the effects of changing environmental conditions on the detector's stability [1]. This system was designed to sample and continuously average the environment surrounding the detector, thereby smoothing short-term transitory excursions.

This report deals with a series of experiments which compares the NRL fire detection system to a commercially developed dynamic detection system and a commercially developed "static" single-station fire detector. These experiments include conditions that might be expected in shipboard environments. The five environmental conditions were purposefully adjusted to extremes to encompass real Navy environments.

Manuscript submitted June 9, 1979.

DETECTION SYSTEM DESIGN

Sampling Chambers

The detector aboard ship encounters air-flow extremes, changing temperature, and humidity, depending on its location. In addition, there are unique problems associated with machinery spaces and fuel and material storage areas which produce aerosols that a detector may identify as fire-generated aerosols.

The sampling head of the NRL fire detection system was designed to operate in extreme ambients and to average or smooth the environment. This is accomplished in the sampling head (seen in Fig. 1) by an averaging flask which acts as an exponential dilution flask. The input air flow passes by the averaging flask where a small portion of the total air flow is siphoned, thus diluting the contents of the averaging flask. This continuous dilution effect acts to average the contents of the flask and smooth environmental ambiguities which effect false alarming.

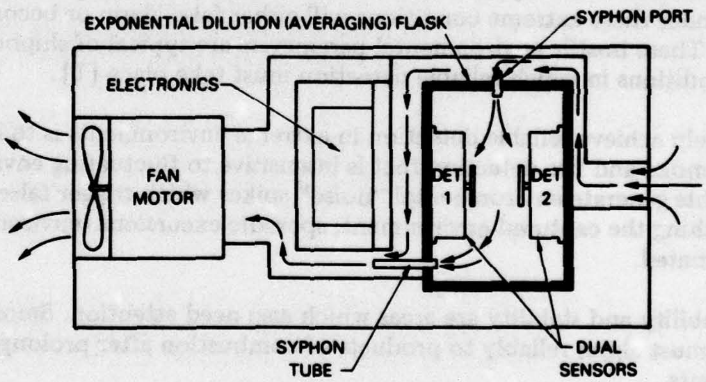

Fig. 1 — NRL Fire Detection System

Detectors

Two ionization-type sensors are employed within the sampling head, both of which monitor the contents of the averaging flask. The two sensors are of the dual-chamber type (Pyrotronics D7 models). These dual-chamber sensors have two ion chambers each; one is used as a reference to compensate for slow changes in temperature and humidity (reducing false alarming due to slow environmental changes) and is partially open to the atmosphere, and the other serves as the detection chamber which is totally open to the atmosphere. In the NRL sampling head the detection chambers monitor the contents of the flask.

The sampling head is designed to sample particle sizes in the 0.01- to 20-μm range. Particle sizes above this range will not enter the flask. One ionization sensor replaces, for test purposes, a photoelectric detector. At some future time one of the ionization detectors

will be replaced with a photoelectric detector to sense fire-generated aerosols to which the ionization-type detector is not highly sensitive.

Microprocessor

Upon changing environmental conditions, the electronic modules within the sampling head sense the first detector's analog output and speed the fan. This change in fan speed does two things:

- It increases the siphon rate of the averaging chamber, and
- It trys to clear the averaging chamber of short-term contaminants.

Each detector has a unique output. These two analog signals are input to the signal processor section of the fire detection system; the section is described in detail in Ref. 1. The hand-wired logic has now been transcribed to an Intel 8085 microprocessor.

The NRL fire detection system has a multiple alarm-level output. This output consists of four levels which are as follows: Level 1 indicates a change in the environment; Level 2 indicates that ordinary ambient conditions have been well exceeded; Level 3 asserts that conditions are clearly abnormal; Level 4 indicates that immediate corrective action should be initiated.

ENVIRONMENTAL TEST CHAMBER

The environmental test chamber (Fig. 2) described in NRL Memorandum Report 3680 [1] was modified for this series of test runs comparing the three detection systems. Tests were conducted while burning a large variety of fuels under different humidity, temperature, and air-flow conditions.

The ability to burn all types of fuels without the transfer of additional heat into the detection area is accomplished by extending the test chamber to include an aerosol generation chamber. The extension allows burning of liquid and solid fuels while baffling the heat and passing only the products of combustion.

To accomplish control over humidity, a steam manifold was constructed adding steam to the chamber in three places after the circulation fan (see Fig. 2). This permits a relative humidity of close to 100% at 71°C (160°F).

To control heat within the chamber, a hot plate is placed in the bottom of the circulating chamber, after the circulation fan, the temperature of which is controlled by a Variac. Air-flow control is accomplished using three 3.15-m^3/min (110 CFM) muffin fans—one input, one circulation, and one exhaust—as described in Ref. 1.

Light attenuation (% obscuration) due to generated aerosols is measured using a 6-V auto headlamp mounted at one end of the chamber and a photo-transistor detector at the

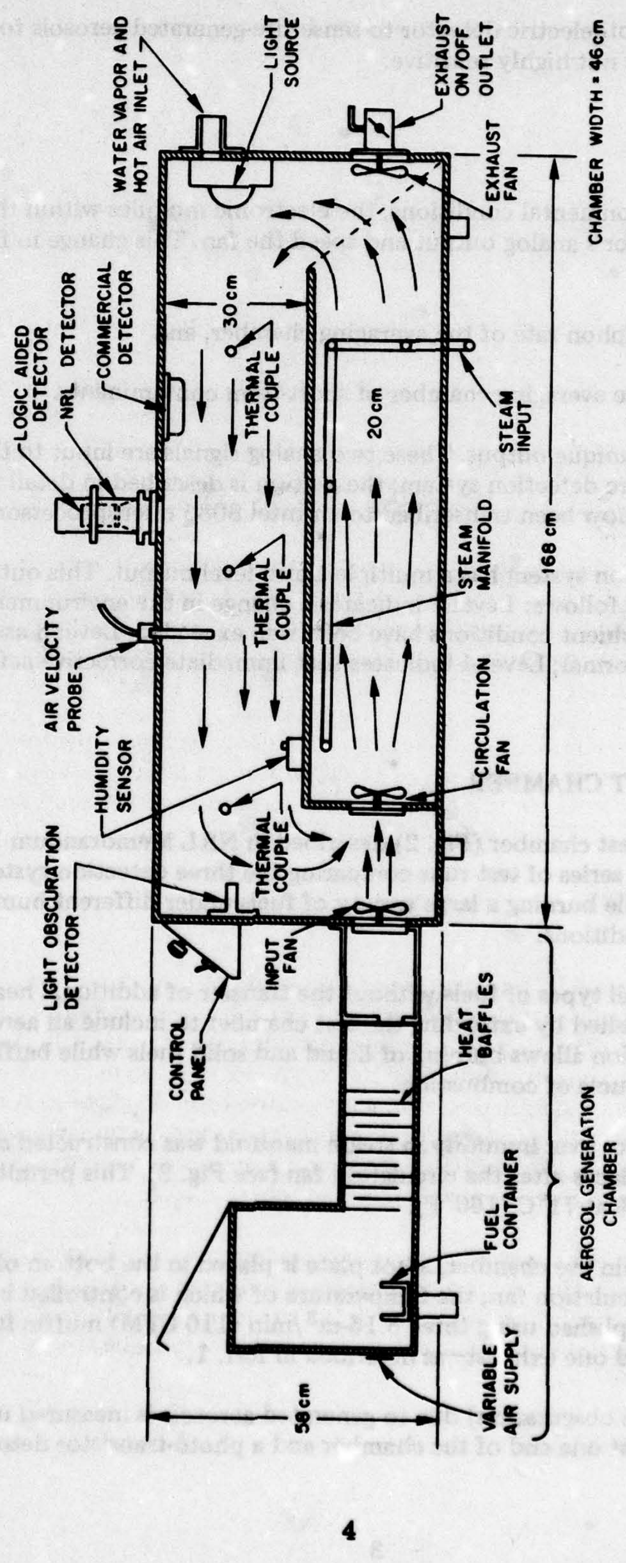

Fig. 2 Environmental test chamber

opposite end. An air-velocity meter manufactured by Hastings Raydist Corp. (Model AB-27) has its probe located at approximately the center of the chamber near the detectors. This probe may be adjusted vertically.

Three thermocouples positioned as shown (see Fig. 2) are inserted through the side to the center of the chamber. Percent relative humidity is measured by a Thunder Scientific Corp. Model PC 2000 humidity sensor.

RELIABILITY

Reliability of fire detectors aboard naval ships is vitally important to fire safety and confidence in the fire detection system. In addition to operating in changing temperatures, humidities, and air flows, a fire detector must be capable of operating in "dirty" environments, i.e., dust, oil spray, fuel spray, for extended periods of time. It must remain capable of detecting products of combustion without suffering from the effects of its environment.

Since long-term fire detector reliability is an important aspect of the total fire detector system, it was tested in the extended series of experiments being reported here (Table 1). Simulation of the polluted or dirty environment was accomplished by subjecting the three detectors to consecutive fire runs without cleaning the detectors between runs. Fuels burned during the test runs included: aviation fuel (JP-4), hexane, benzene, urethane, styrene, paper, wood, oily rags, oil, mag tape, and paints. The petroleum-based fuels produced heavy sooty smoke, while smoldering oil rags produced dense oil-laden smoke. All test runs were accomplished consecutively without cleaning the detectors except when the deposits made the detector insensitive to products of combustion; then only the inoperable detector was cleaned. Since reliability was determined to be an important factor in this series of tests, the ability to give sustained, early, reliable detections was monitored for decreases in the detector's sensitivity to products of combustion.

RESULTS

The appendix lists the 100 experiments conducted with the detectors. Run #39 has been selected as an example and is shown in Fig. 3. This run compares the results obtained from the three detectors. The first is a commercially developed, residential ionization detector; the second is a commercially developed prototype logic-aided detector. Third is the NRL-developed processor-aided detector which, because of multiple detectors, has two analog outputs. The location of the three detectors for these experiments is seen in Fig. 2. The data plot, Fig. 3, also includes obscuration with a scale of 5:1. The maximum obscuration reached during this run was approximately 14% per 30.5 cm.

The fuel used in this run was an oily cloth wrapped around a 50-W, 120-V soldering iron as an ignition source. The environment was low temperature 37.8°C (100°F), high humidity 90% RH, and air flow approximately 2.8 m^3/min (100 CFM). Temperature, humidity, and air flow were stabilized at the above levels before the start of the run. Total run time was 480 s.

Table 1 — The Effect of Temperature and Humidity on the Fire Detector's Response

Temp. °C (°F)	Percent Humidity	Fire Detector*		
		Commercial Single-Station Static	Commercial Logic-Aided	NRL Processor-Aided
29.4 (85)	27	+	+	+
29.4 (85)	99	+	+	+
54.5 (130)	99	+	+	+
60.0 (140)	99	+		+
65.5 (150)	99	+	−	+
71.1 (160)	99	+	−	+
71.1 (160)	5	+	+	+

*+ = Reliable operation
− = Unreliable operation

At 115 s into the run, the percent obscuration starts rising at a rapid rate. At the same time the commercial logic-aided detector analog signal starts rising slowly, followed some 20 s later by the NRL #1 analog. At about 150 s the NRL detector gives its first stage of alarm. At this time the percent obscuration is 1.5%/ft (30.5 cm). (It may be noted that the smoke generated by smoldering oily rags is very heavy and oil laden, resulting in large particles. The large particle size slows the response time in ionization detectors.) Approximately 30 s later at 180 s into the run, the NRL second stage of alarm is given. At the same time, the commercial detector's analog signal starts to rise. At 185 s the NRL level-three alarm stage is reached. After approximately 195 s NRL alarm level four is reached, at which time the obscuration is 10%/ft. At 230 s the commercial detector goes into its single alarm; obscuration at this time is 12.5%/ft. At 315 s the logic-aided detector gives its single alarm, and at 320 s, the test chamber exhaust fan is turned on and fuel is removed from the smoke generator. At about 340 s, the logic-aided analog signal starts dropping, followed by the obscuration at 375 s, the commercial at 410 s and the #1 and #2 NRL analog at 430 s. The environment within the chamber is normal at 475 s.

Over the 150 test fires, only one unit, the logic-aided commercial detector, failed to operate because of continuous contamination from previous fires. The logic-aided commercial detector also exhibited high failure rates when exposed to high humidity levels. The fire tests with temperatures over 54.5°C (130°F) and high humidity do not include the logic-aided fire detector because it was inoperable at these levels. The processor-aided NRL detector and the static commercial completed all test runs.

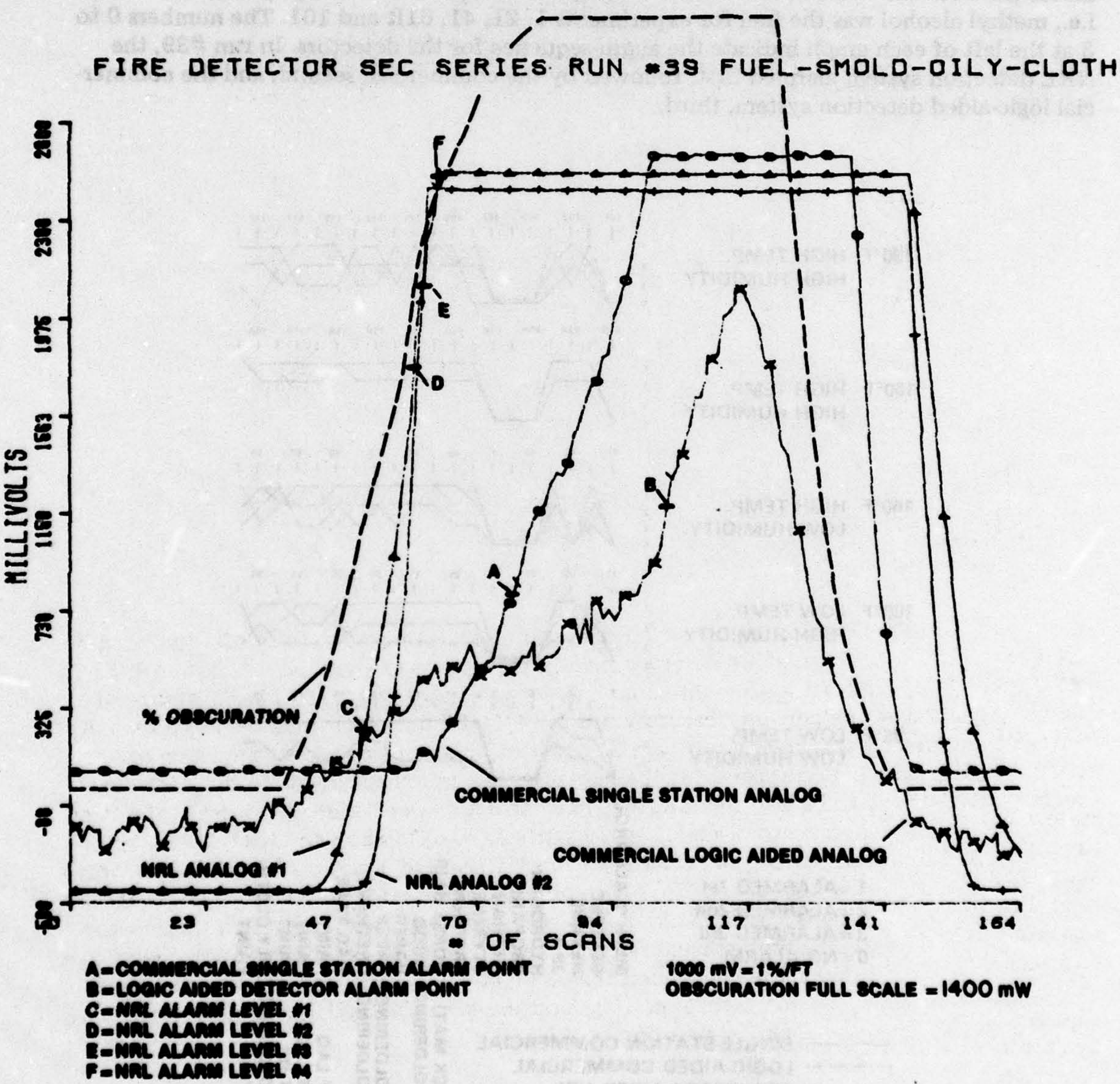

Fig. 3 — Fire detectors' response to smoldering oily cloth

Graphic representations of all the tests are presented in the Appendix. An overall correlation of the 100 test runs is shown in Fig. 4. These test runs are divided into five temperature and humidity groups, shown on the left, with 20 runs each. The fuels burned are shown across the bottom. The numbers above the graphs correspond to the experiment numbers; i.e., methyl alcohol was the fuel for experiments 1, 21, 41, 61R and 101. The numbers 0 to 3 at the left of each graph indicate the alarm sequence for the detectors. In run #39, the NRL detection system alarmed first, followed by the commercial, second, and the commercial logic-aided detection system, third.

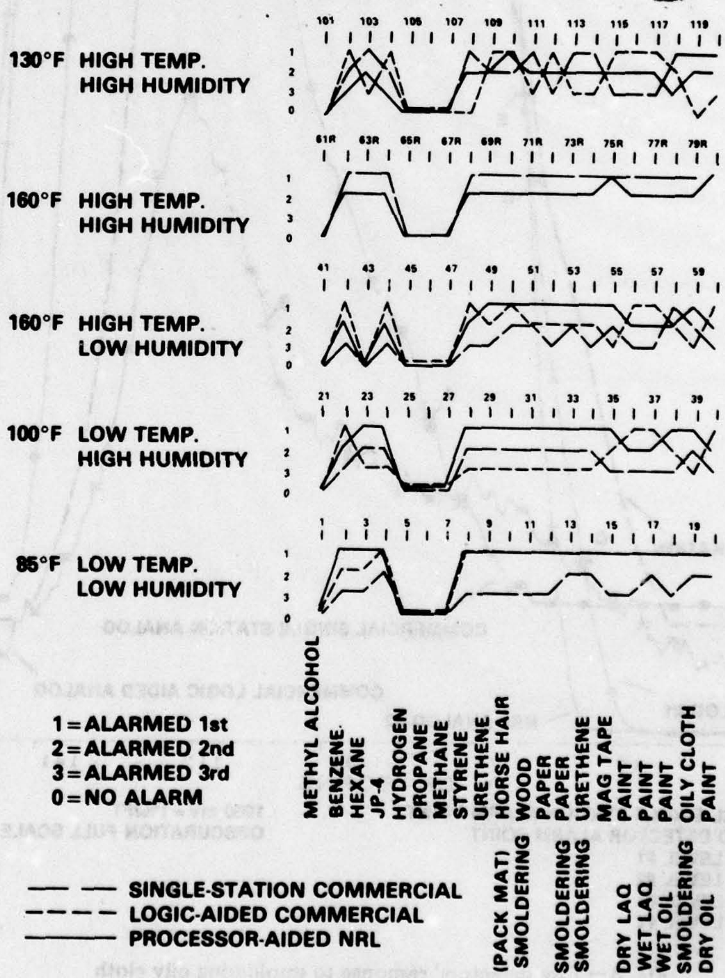

Fig. 4 — Summary representation of the 100 fire detector tests

It may be noted the letter following the run number on runs 61 "R" to 80 "R" means those particular tests were repeated. Runs 61 through 80 were repeated in an attempt to make the logic-aided detector functional under these conditions.

SUMMARY AND CONCLUSIONS

The results of the series of fire tests being reported indicate the ability to "build in" stability and reliability. The NRL fire detection system exhibited stable operation, endured 150 test runs in changing and hostile environments, and was still capable of an early warning to a fire threat.

NRL Memorandum Report 3680 outlined in its summary a set of characteristics thought to give the best early warning of a fire situation. That outline must now be expanded to include two factors not considered at that time: reliability and stability. Below are the detection characteristics as they are now envisioned.

1. Capable of fast, accurate detection.
   - Can indicate a true fire threat within a reasonably short time.
2. Able to convey additional information.
   - Shows immediate indication of potential threat.
   - Indicates increasing magnitude of threat.
3. Versatile.
   - Can be made specific for a particular application.
   - Increases sampling rate when products of combustion are present.
4. Environmentally adaptive.
   - Discriminates against background noise.
   - Smooths rapid environmental changes.
5. Reliable.
   - Provides extended operation in hostile environments.
   - Is relatively maintenance free.
6. Stable.
   - Indicates accurately a potential fire threat, at all times, regardless of environmental conditions associated with its location.

Reliability and stability become more important factors to consider when hostile changing environments are encountered. Fire detection systems that were conceived and designed for friendly environments lack the needed stability to operate effectively in hostile areas.

ACKNOWLEDGMENTS

The authors wish to thank Dr. Doren Indritz, Mr. Omar Ahmed, and Miss Susan Rose, who developed the computer program for handling the data. The authors also wish to thank Dr. Homer Carhart for many helpful discussions associated with this work.

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Appendix A

COMPILATION OF THE 100 FIRE TESTS

Run #	Temperature (°F)		Run Time (s)	% RH	Time of Exhaust Turn-on (s)
	Start	End			
1 Methanol	86	86	360	28	—
2 Benzene	86	85	390	27	180
3 Hexane	82	84	320	27	120
4 JP-4	84	85	420	27	120
5 Hydrogen	84	86	300	27	—
6 Propane	76	87	300	27	—
7 Methane	87	88	210	27	—
8 Styrene	88	87	315	27	135
9 Urethane	87	87	375	27	190
10 Packing Material ("horse hair")	87	88	345	27	210
11 Wood Smoldering	86	88	285	27	180
12 Paper Flaming	86	85	225	27	105
13 Paper Smoldering	86	86	1,065	27	915
14 Urethane Smoldering	84	84	570	28	440
15 Mag Tape	81	82	330	28	210
16 Paint (dry laq.)	82	83	270	28	165
17 Paint (wet laq.)	83	84	255	17	105
18 Paint (wet oil)	84	84	240	27	90
19 Oil Cloth Smoldering	84	84	540	27	390
20 Paint (dry oil)	81	82	285	28	150

Run #	Temperature (°F)		Run Time (s)	% RH	Time of Exhaust Turn-on (s)
	Start	End			
21 Methanol	90	100	210	85	—
22 Benzene	100	98	255	85	135
23 Hexane	98	100	270	85	180
24 JP-4	109	108	270	90	180
25 Hydrogen	86	88	240	75	—
26 Propane	88	92	180	80	—
27 Methane	99	100	120	80	—
28 Styrene	96	96	330	85	240
29 Urethane	96	100	315	90	210
30 Packing Material ("horse hair")	90	94	360	90	300
31 Wood Smoldering	92	95	300	90	195
32 Paper Flaming	95	94	270	90	180
33 Paper Smoldering	94	95	360	90	300
34 Urethane Smoldering	100	92	390	90	240
35 Mag Tape	96	96	285	90	120
36 Paint (dry laq.)	96	96	180	90	75
37 Paint (wet laq.)	96	98	225	90	120
38 Paint (wet oil)	108	110	270	83	120
39 Oil Cloth Smoldering	100	102	480	90	300
40 Paint (dry oil)	100	102	240	90	105

Run #	Temperature (°F) Start	End	Run Time (s)	% RH	Time of Exhaust Turn-on (s)
41 Methanol	156	158	120	5	—
42 Benzene	157	156	240	8	105
43 Hexane	158	158	120	5	—
44 JP-4	158	159	255	5	135
45 Hydrogen	160	160	90	5	—
46 Propane	159	160	135	4	—
47 Methane	160	160	150	5	—
48 Styrene	160	160	270	4	120
49 Urethane	160	160	180	4	75
50 Packing Material ("horse hair")	152	150	240	5	60
51 Wood Smoldering	158	160	195	4	105
52 Paper Flaming	156	154	270	4	135
53 Paper Smoldering	162	158	330	3	240
54 Urethane Smoldering	162	158	225	3	135
55 Mag Tape	160	162	240	4	165
56 Paint (dry laq.)	162	162	195	3	90
57 Paint (wet laq.)	162	164	270	3	90
58 Paint (wet oil)	161	164	255	2	120
59 Oil Cloth Smoldering	160	158	405	2	315
60 Paint (dry oil)	153	157	270	2	105

Run #		Temperature (°F) Start	End	Run Time (s)	% RH	Time of Exhaust Turn-on (s)
61R	Methanol	162	160	135	80	135
62R	Benzene	159	148	210	98	90
63R	Hexane	160	160	300	80	225
64RB	JP-4	154	153	210	100	60
65R	Hydrogen	160	160	90	85	—
66R	Propane	152	154	90	70	—
67R	Methane	130	128	150	98	—
68R	Styrene	160	160	285	91	165
69R	Urethane	150	145	180	98	75
70R	Packing Material ("horse hair")	156	154	270	80	75
71R	Wood Smoldering	163	160	390	95	255
72R	Paper Flaming	156	156	195	62	105
73R	Paper Smoldering	157	150	555	98	—
74RB	Urethane Smoldering	156	157	420	97	270
75R	Mag Tape	156	150	255	97	105
76R	Paint (dry laq.)	160	155	285	99	225
77R	Paint (wet laq).	160	144	180	95	75
78R	Paint (wet oil)	161	145	300	100	150
79R	Oil Cloth Smoldering	167	158	690	80	600
80R	Paint (dry oil)	160	150	240	98	150

*The fire tests with an "R," "B," or "RB" following the run number were rerun because the commercial logic-aided detector failed to operate in the initial run. Runs labeled RB were rerun more than once.

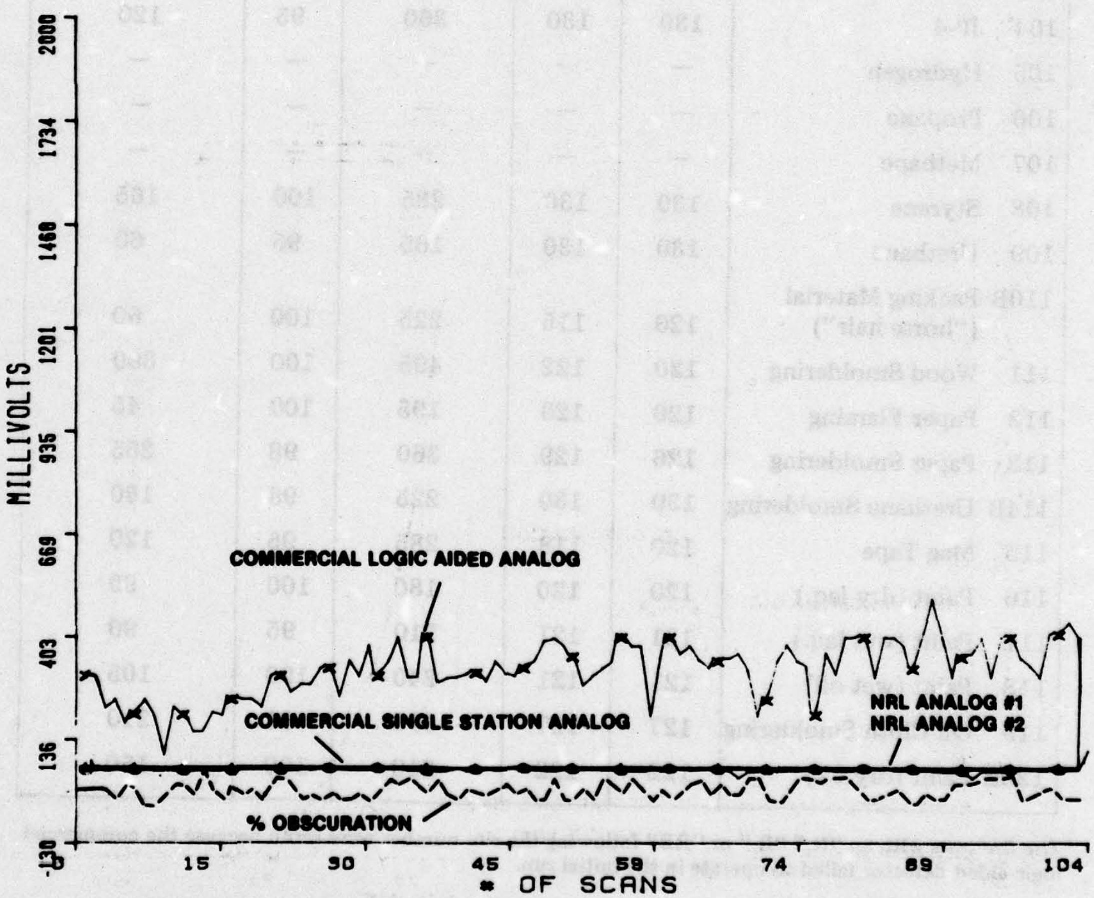
Run #		Temperature (°F)		Run Time (s)	% RH	Time of Exhaust Turn-on (s)
		Start	End			
101	Methanol	134	134	120	90	—
102	Benzene	131	131	210	95	75
103	Hexane	134	134	225	98	240
104	JP-4	130	130	360	95	120
105	Hydrogen	—	—	—	—	—
106	Propane	—	—	—	—	—
107	Methane	—	—	—	—	—
108	Styrene	130	130	285	100	165
109	Urethane	130	130	165	95	60
110B	Packing Material ("horse hair")	120	115	225	100	60
111	Wood Smoldering	120	122	495	100	390
112	Paper Flaming	120	120	195	100	45
113	Paper Smoldering	126	129	360	98	255
114B	Urethane Smoldering	130	130	225	98	150
115	Mag Tape	120	118	285	95	120
116	Paint (dry laq.)	120	120	180	100	90
117	Paint (wet laq.)	121	121	210	95	90
118	Paint (wet oil)	121	121	240	100	105
119	Oil Cloth Smoldering	127	127	300	97	210
120B	Paint (dry oil)	122	122	210	100	150

***The fire tests with an "R," "B," or "RB" following the run number were rerun because the commercial logic-aided detector failed to operate in the initial run.**

Appendix B

TEST RUN PLOTS

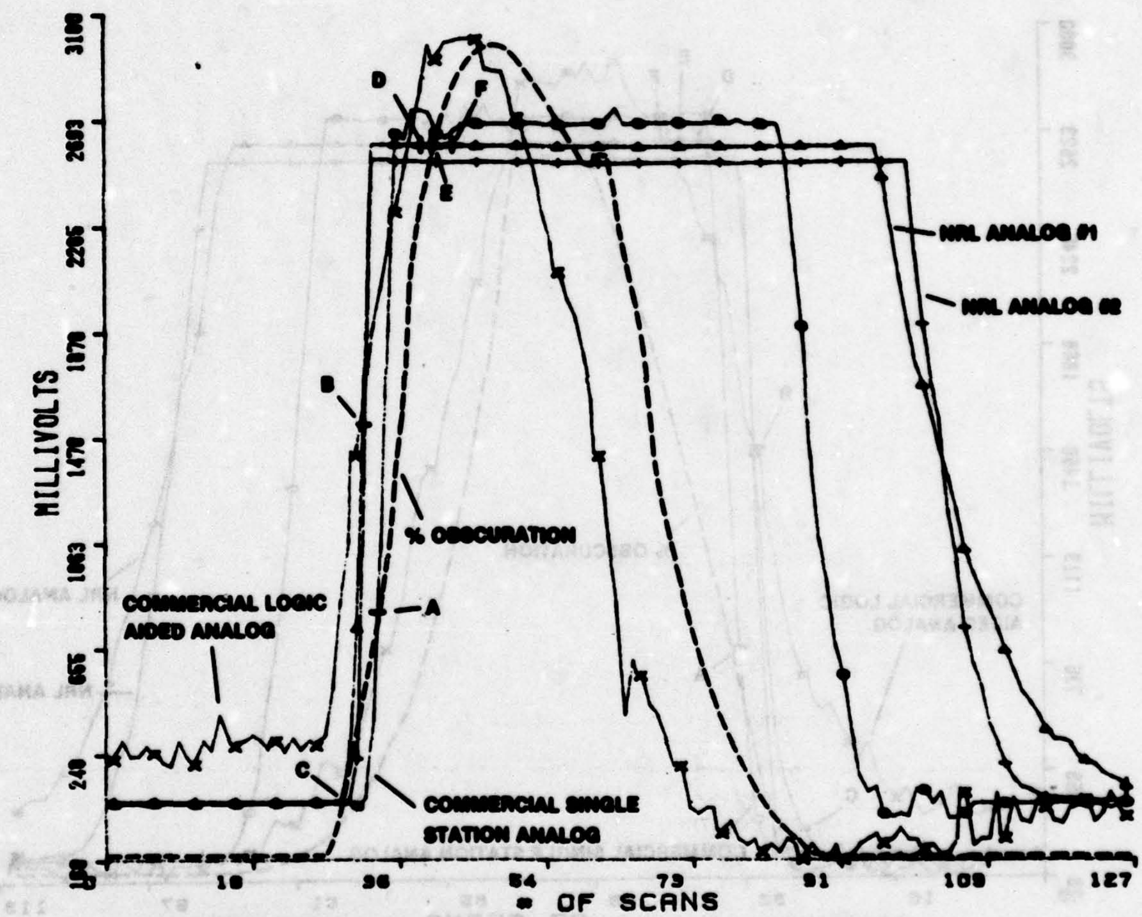
FIRE DETECTOR SEC SERIES RUN #1 FUEL-MEOH



A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

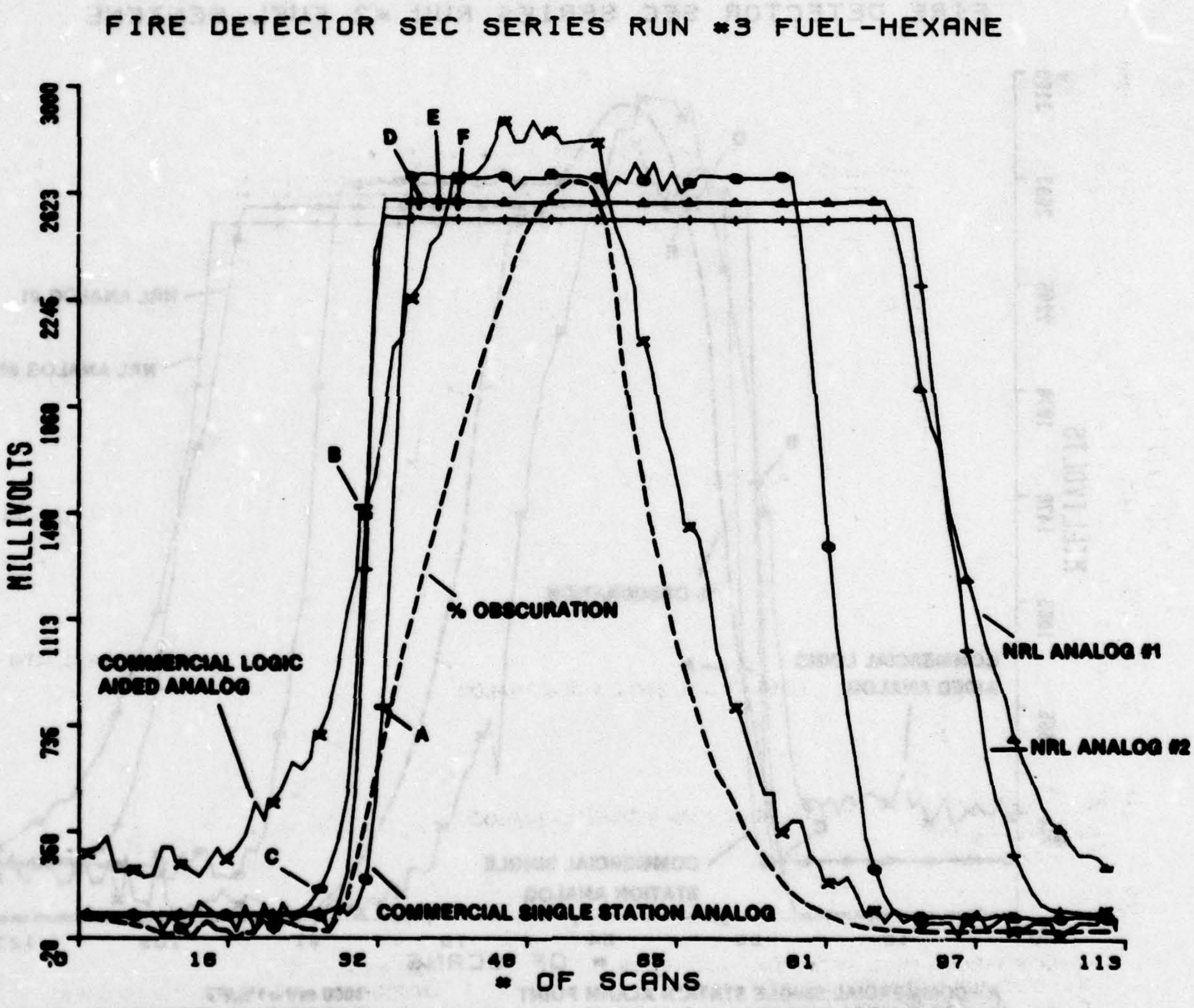
1000 mv=1%/FT
OBSCURATION FULL SCALE = 100 mW
NO ALARM TO THIS FUEL

FIRE DETECTOR SEC SERIES RUN #2 FUEL-BENZENE



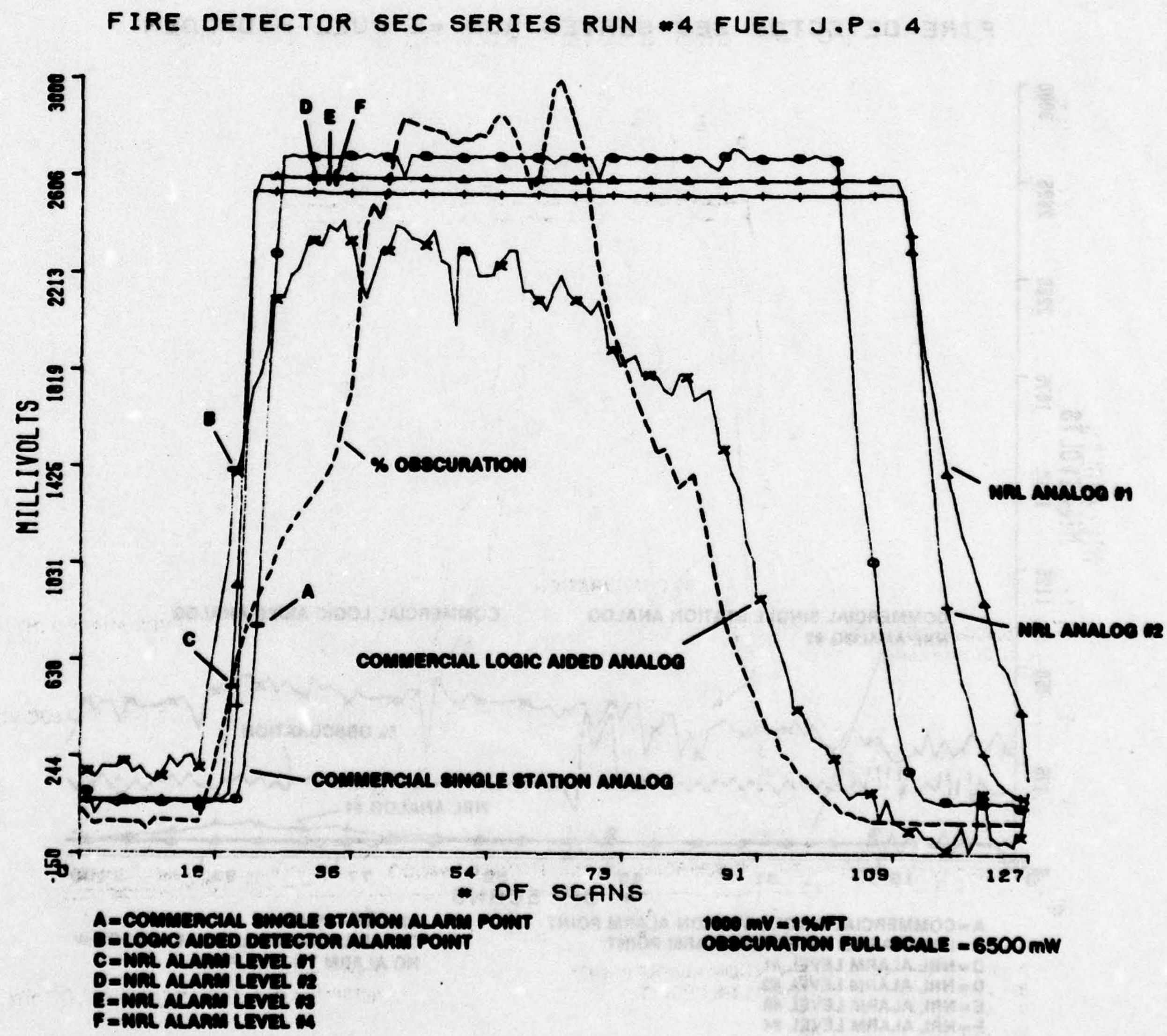
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1400 mW



A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

1000 mV=1%/FT
OBSCURATION FULL SCALE =6000 mW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MILLIVOLTS
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1819
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1031
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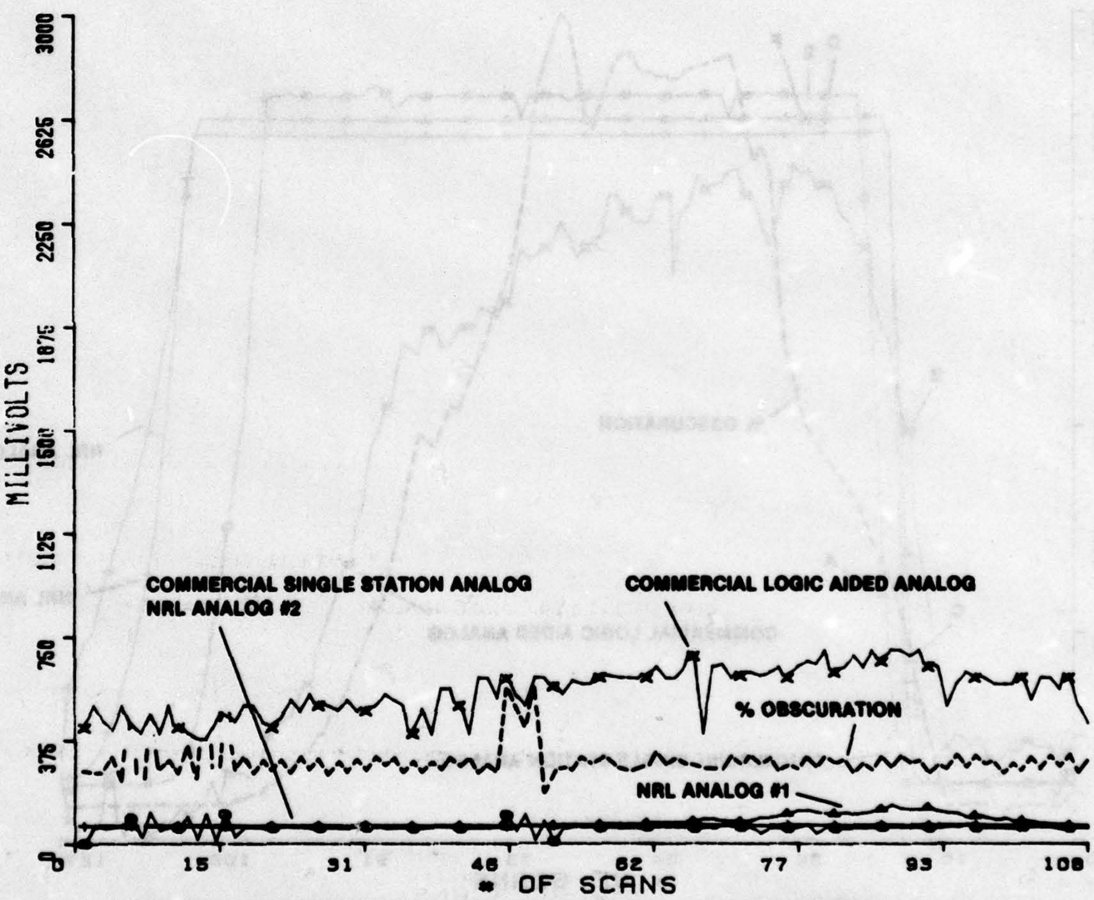
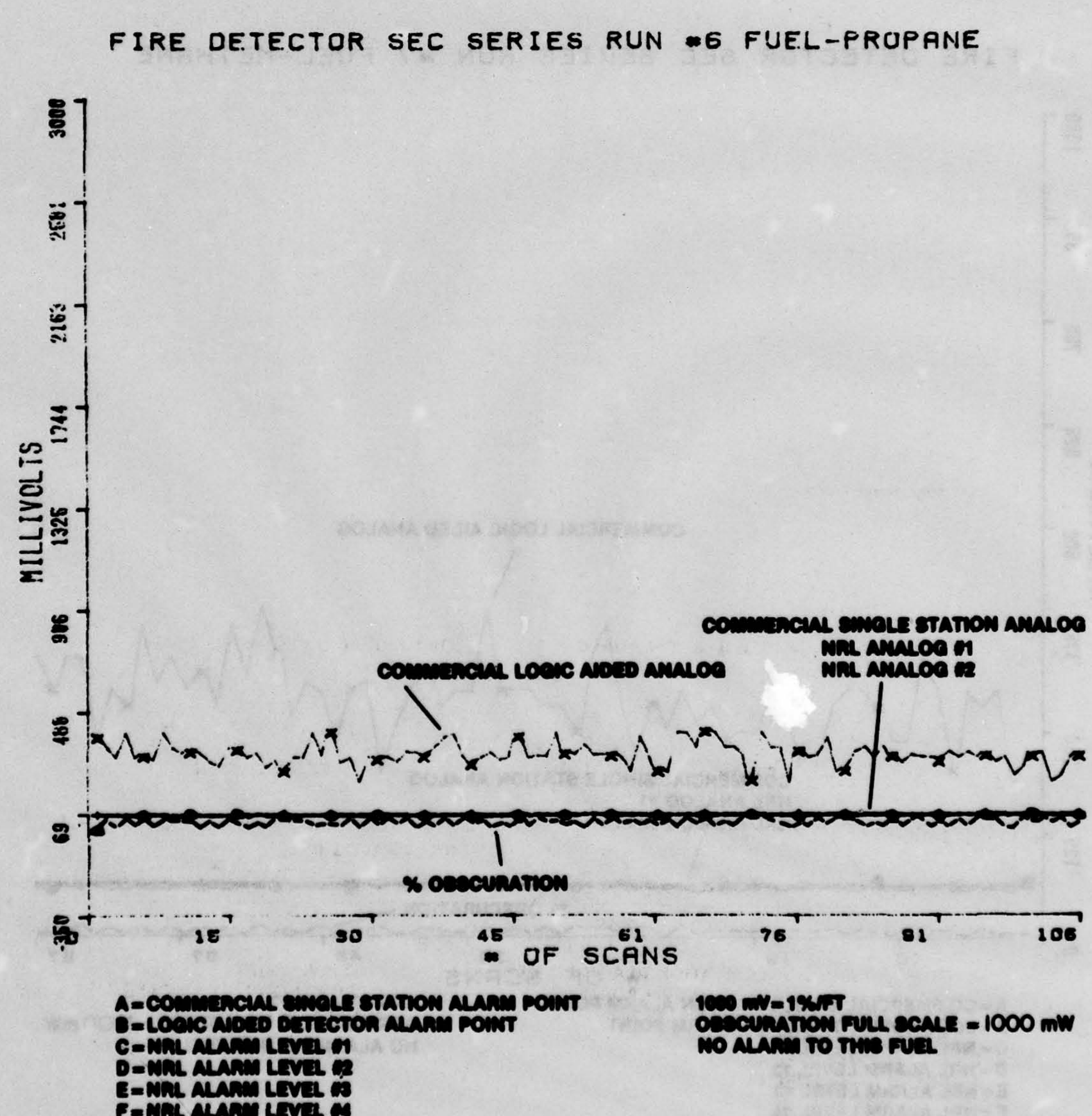
18
36
54
73
91
109
127
OF SCANS
D
E
F
B
C
A
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
COMMERCIAL LOGIC AIDED ANALOG
COMMERCIAL SINGLE STATION ANALOG
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 6500 mW

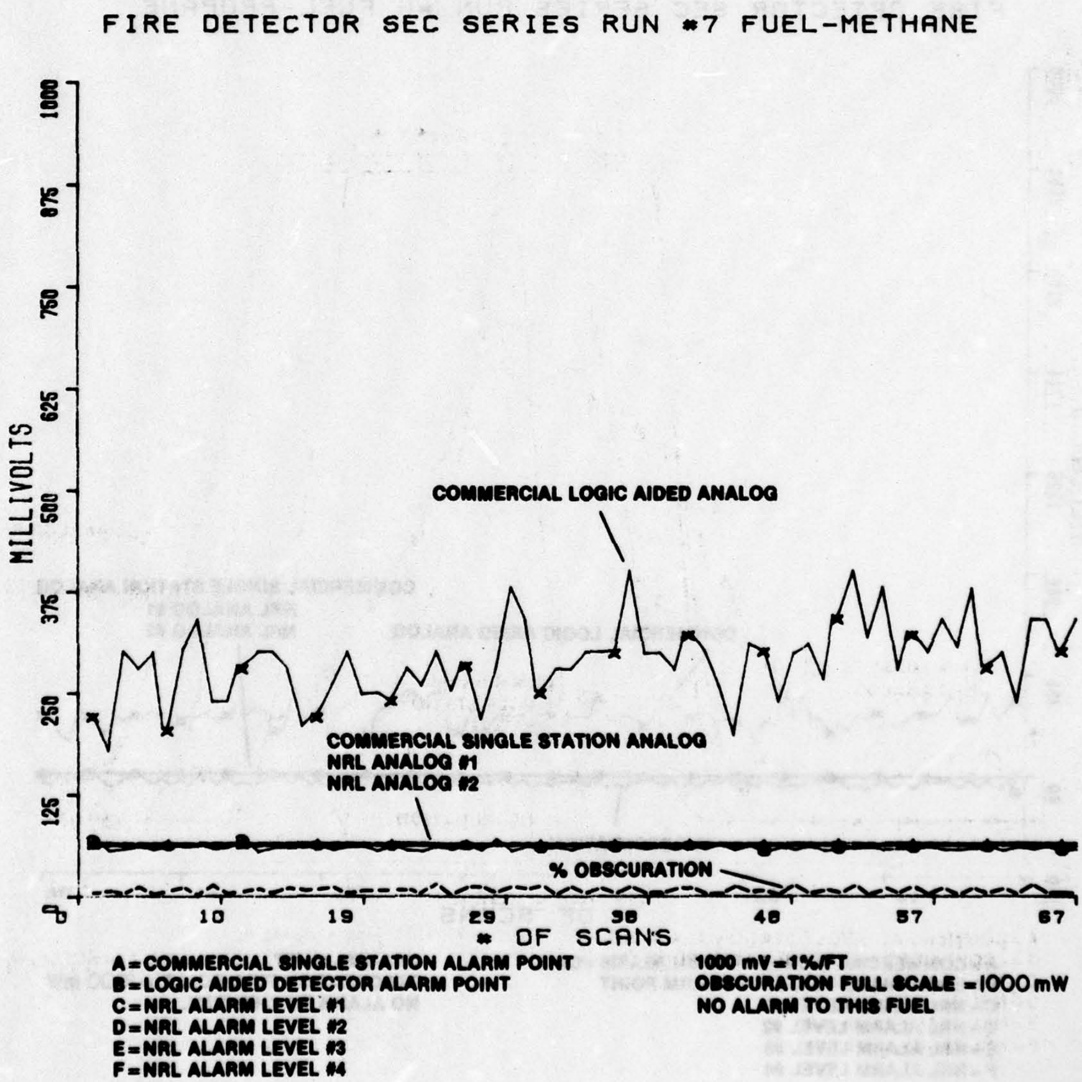
FIRE DETECTOR SEC SERIES RUN #5 FUEL-HYDROGEN

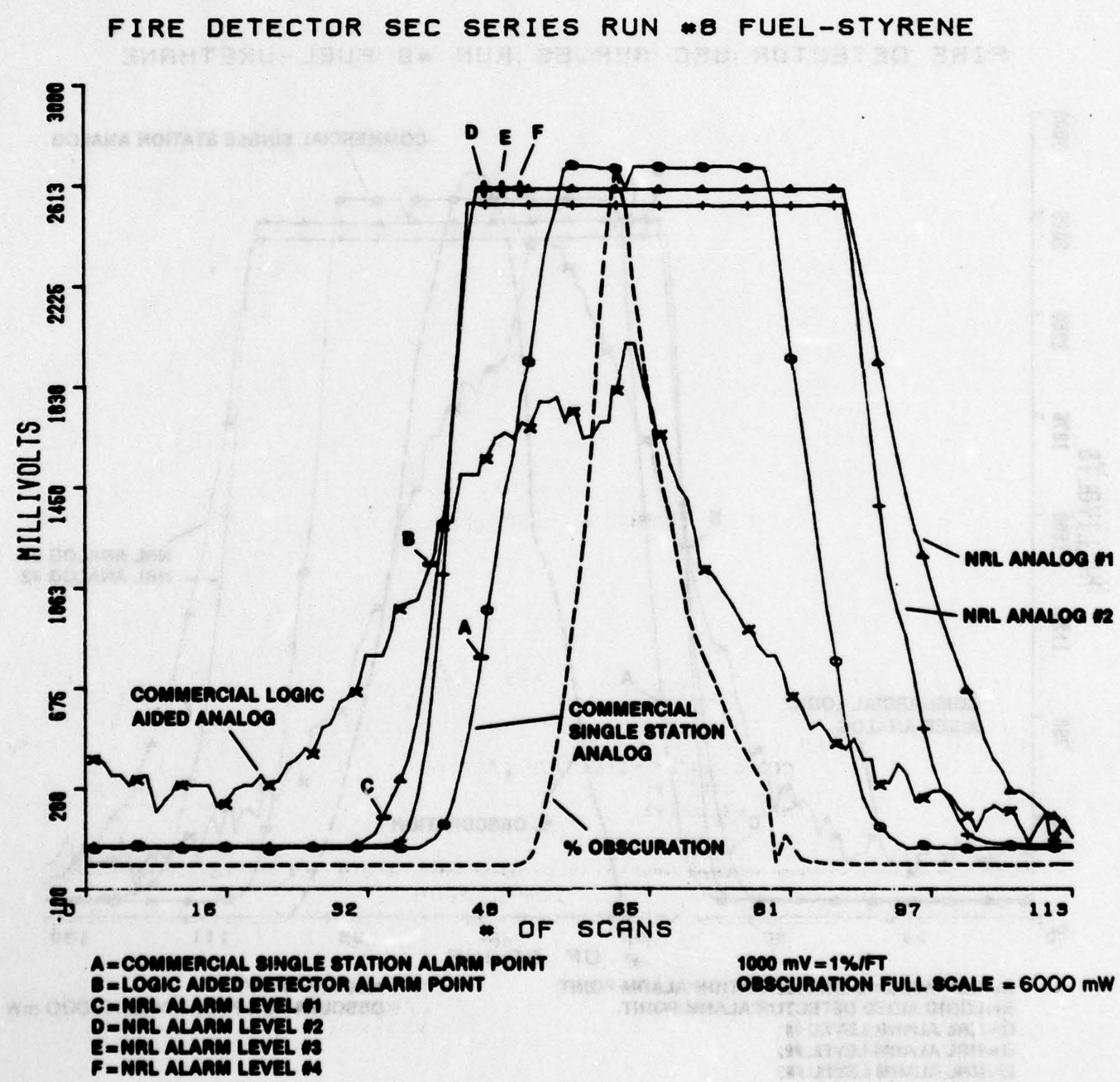


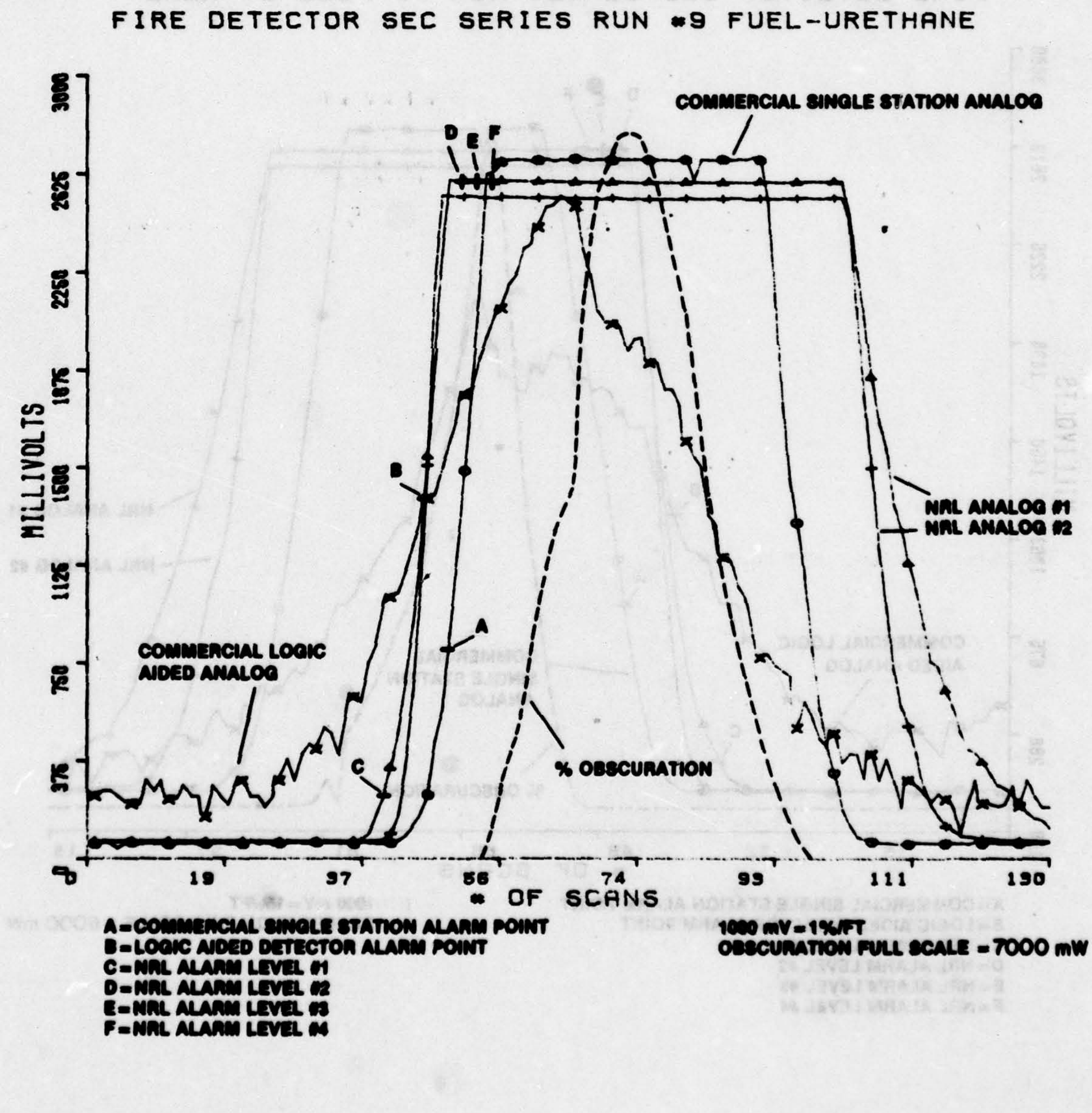
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

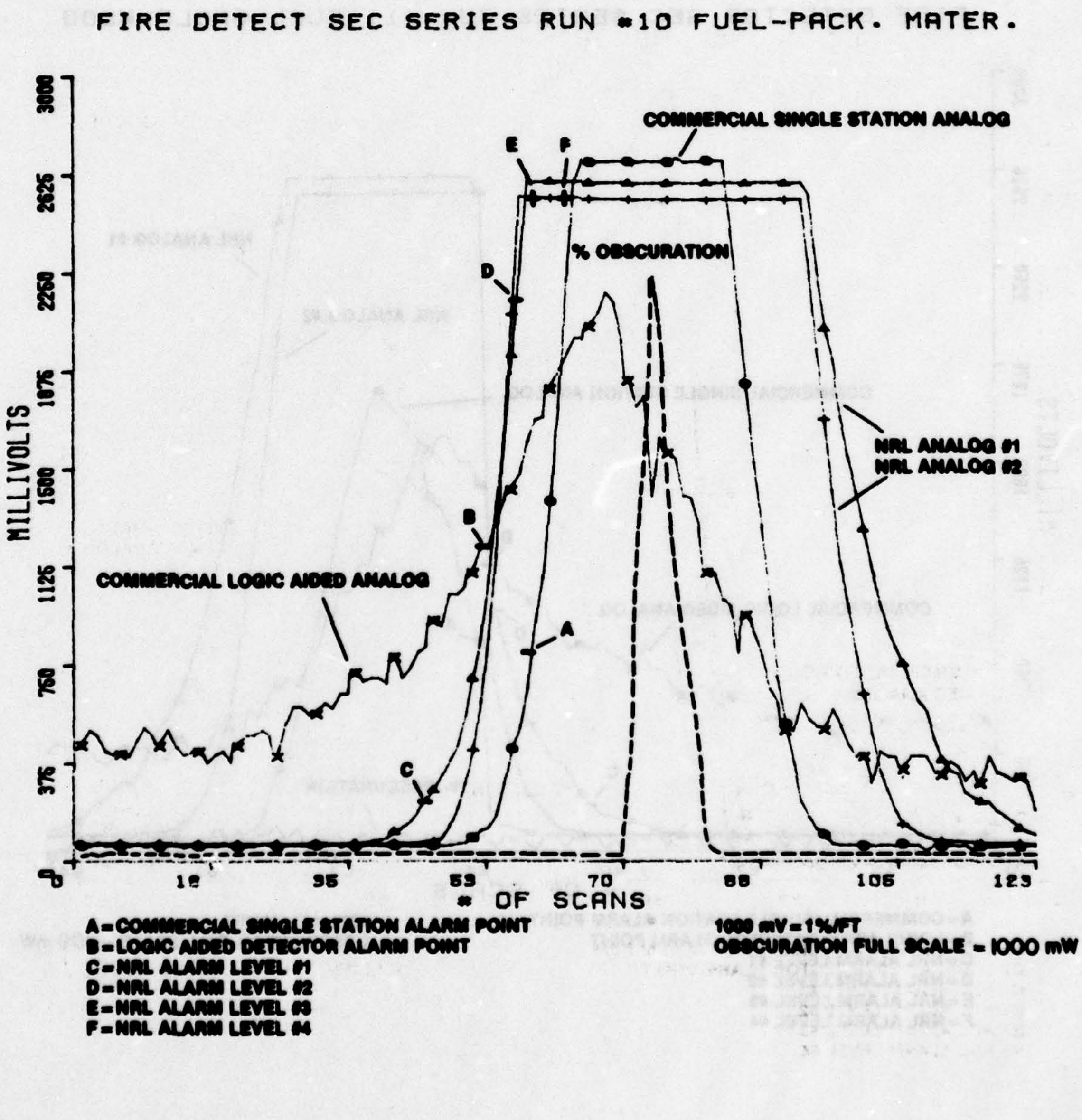
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW
NO ALARM TO THIS FUEL

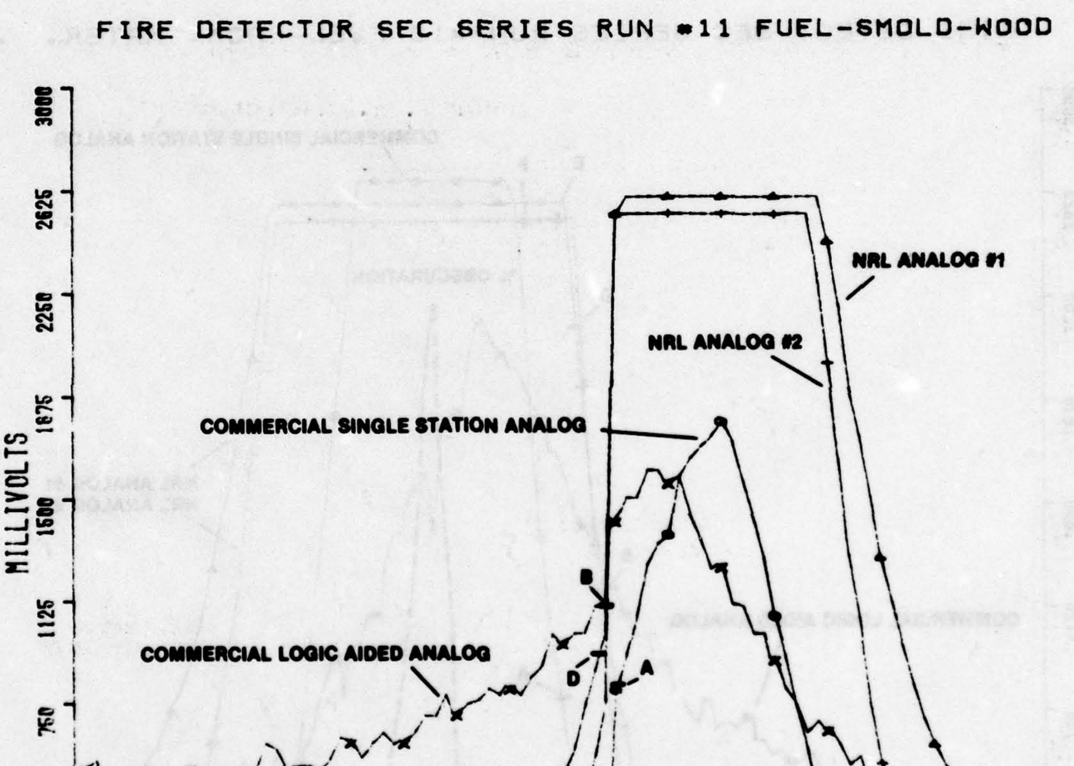

FIRE DETECTOR SEC SERIES RUN #6 FUEL-PROPANE
MILLIVOLTS
3000
2581
2163
1744
1326
906
488
69
-350
0
15
30
45
61
76
91
106
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
NRL ANALOG #1
NRL ANALOG #2
COMMERCIAL LOGIC AIDED ANALOG
% OBSCURATION
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 1000 mW
NO ALARM TO THIS FUEL


FIRE DETECTOR SEC SERIES RUN #7 FUEL-METHANE
MILLIVOLTS
1000
875
750
625
500
375
250
125
0
COMMERCIAL LOGIC AIDED ANALOG
COMMERCIAL SINGLE STATION ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
0
10
19
29
38
48
57
67
# OF SCANS
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1000 mW
NO ALARM TO THIS FUEL


FIRE DETECTOR SEC SERIES RUN #8 FUEL-STYRENE
MILLIVOLTS
3000
2613
2226
1839
1450
1063
675
288
-100
0
16
32
48
65
81
97
113
OF SCANS
D
E
F
B
A
C
NRL ANALOG #1
NRL ANALOG #2
COMMERCIAL LOGIC AIDED ANALOG
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 6000 mW

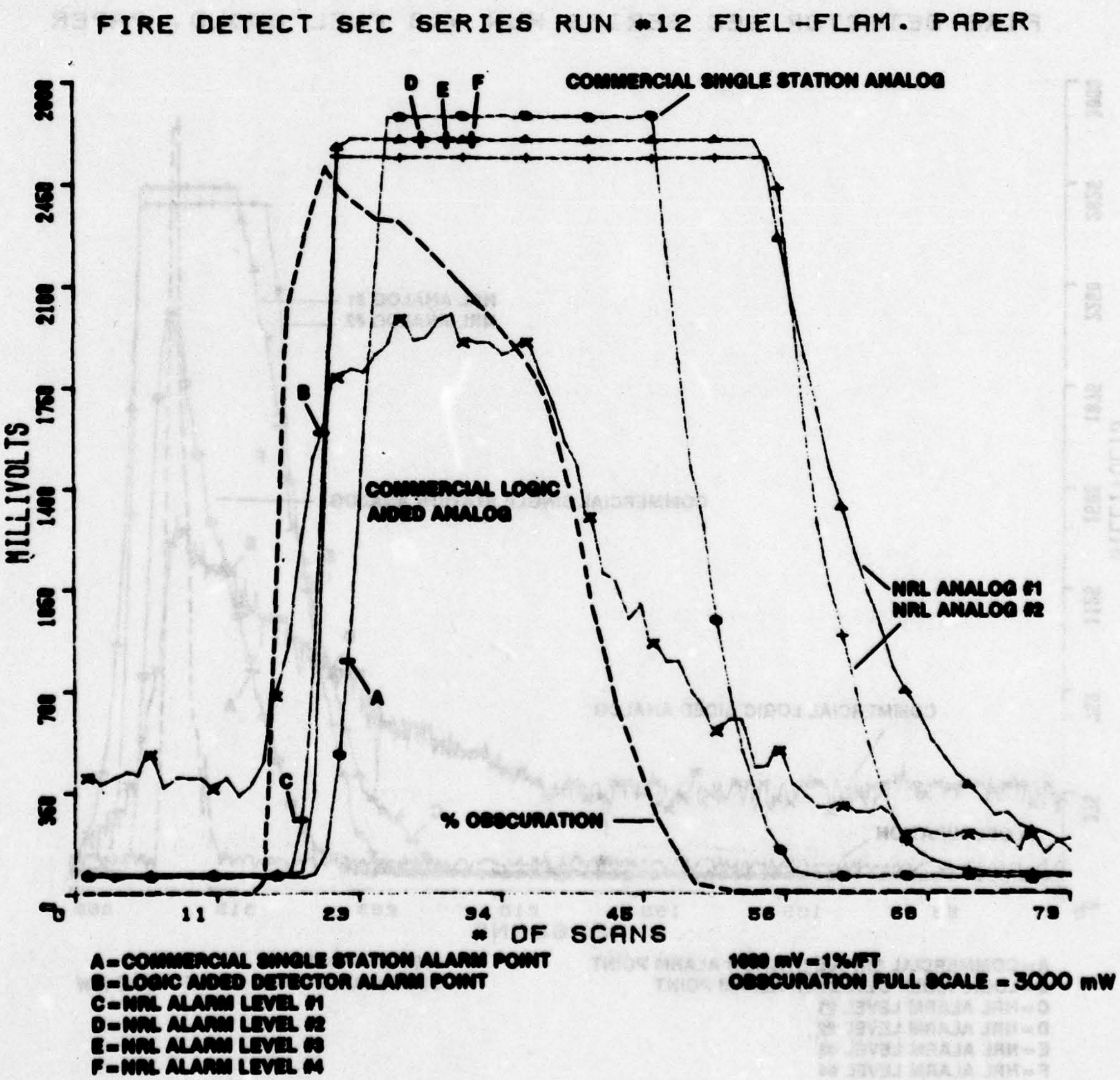

FIRE DETECTOR SEC SERIES RUN #9 FUEL-URETHANE
MILLIVOLTS
3000
2625
2250
1875
1500
1125
750
375
0
0
19
37
56
74
93
111
130
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
D E F
B
A
C
COMMERCIAL LOGIC
AIDED ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 7000 mW

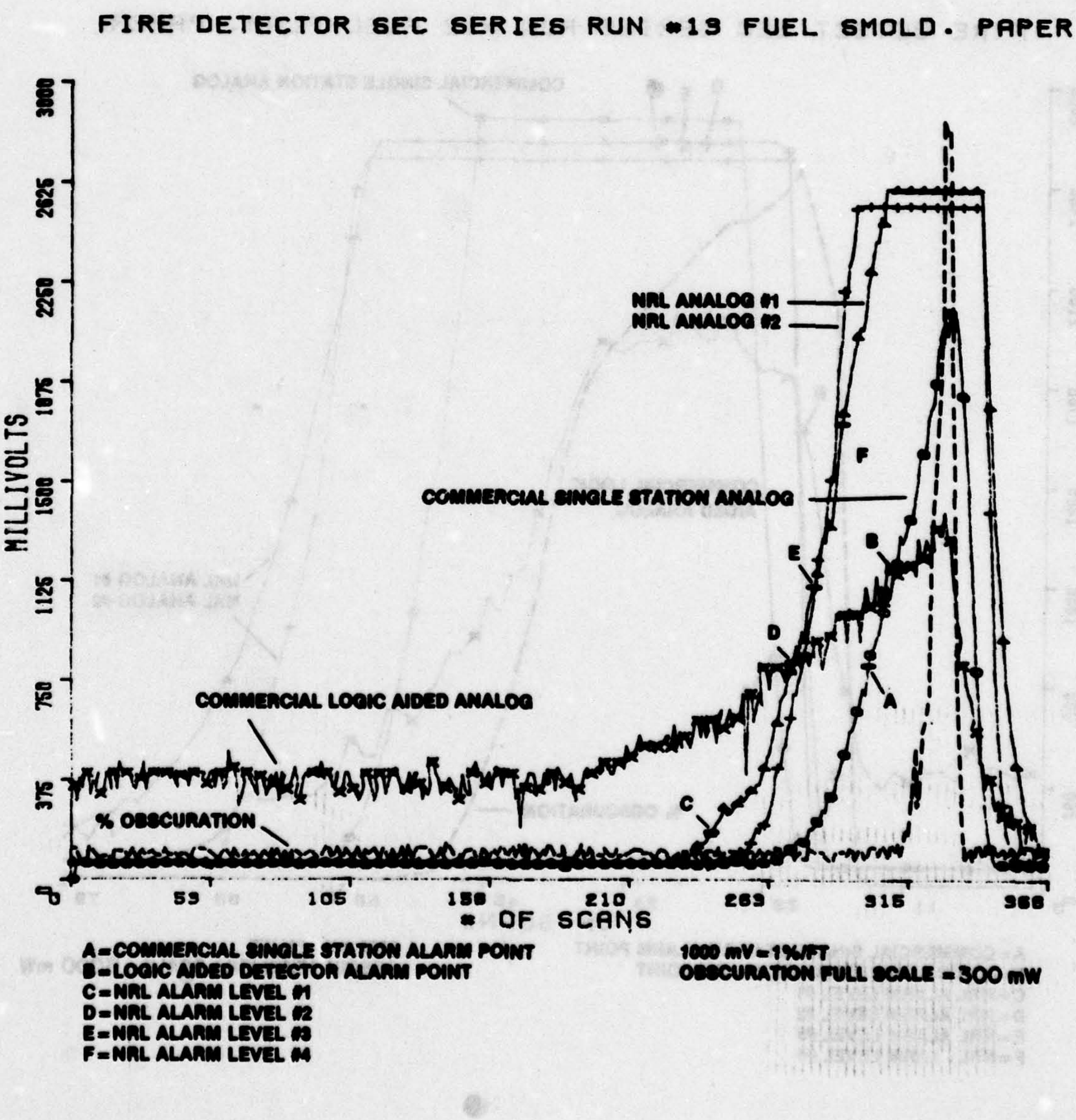

FIRE DETECT SEC SERIES RUN #10 FUEL-PACK. MATER.
MILLIVOLTS
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
COMMERCIAL LOGIC AIDED ANALOG
# OF SCANS
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1000 mW



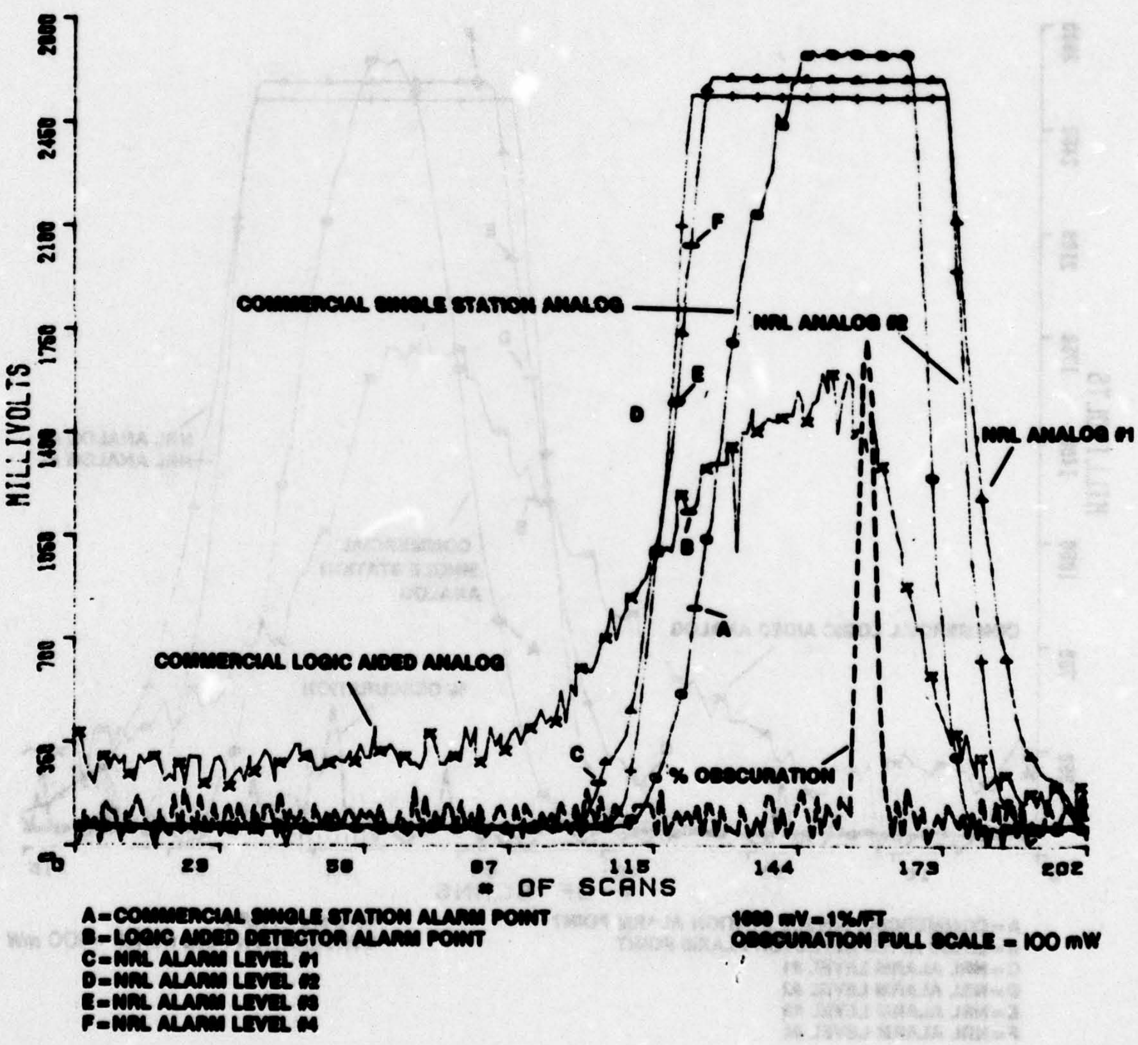
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

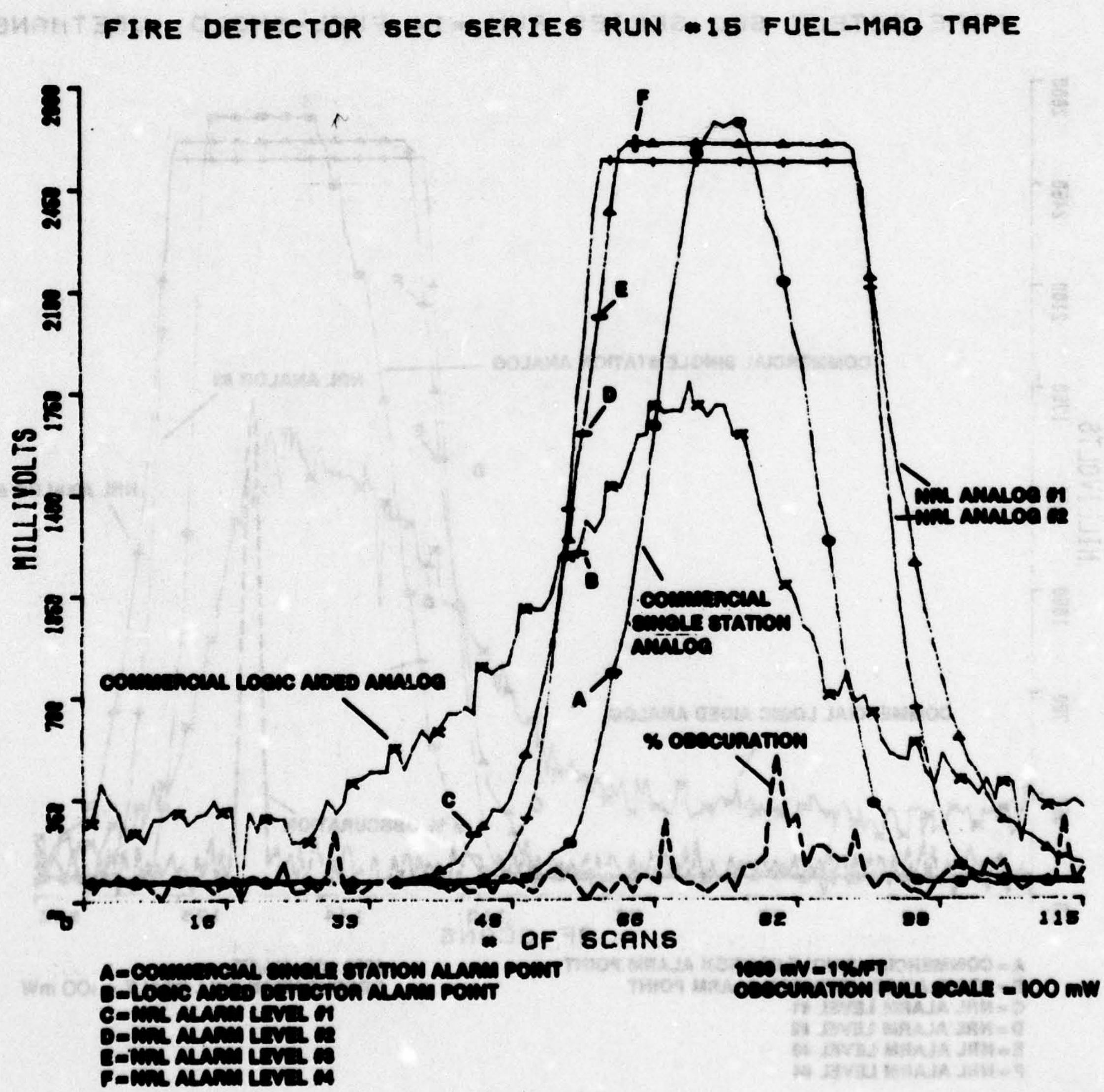
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 100 mW

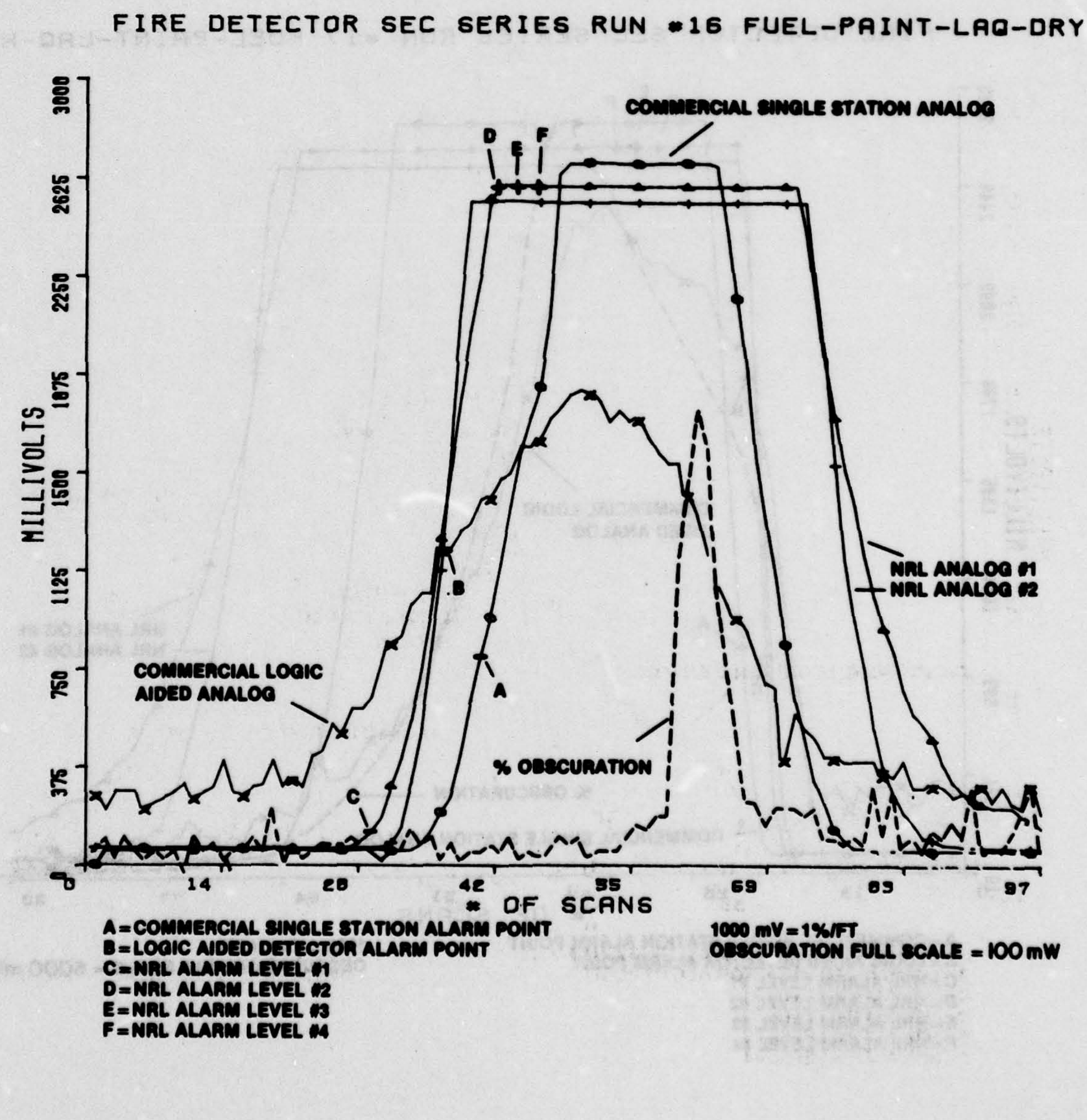

FIRE DETECT SEC SERIES RUN #12 FUEL-FLAM. PAPER
MILLIVOLTS
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
D
E
F
A
B
C
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 3000 mW

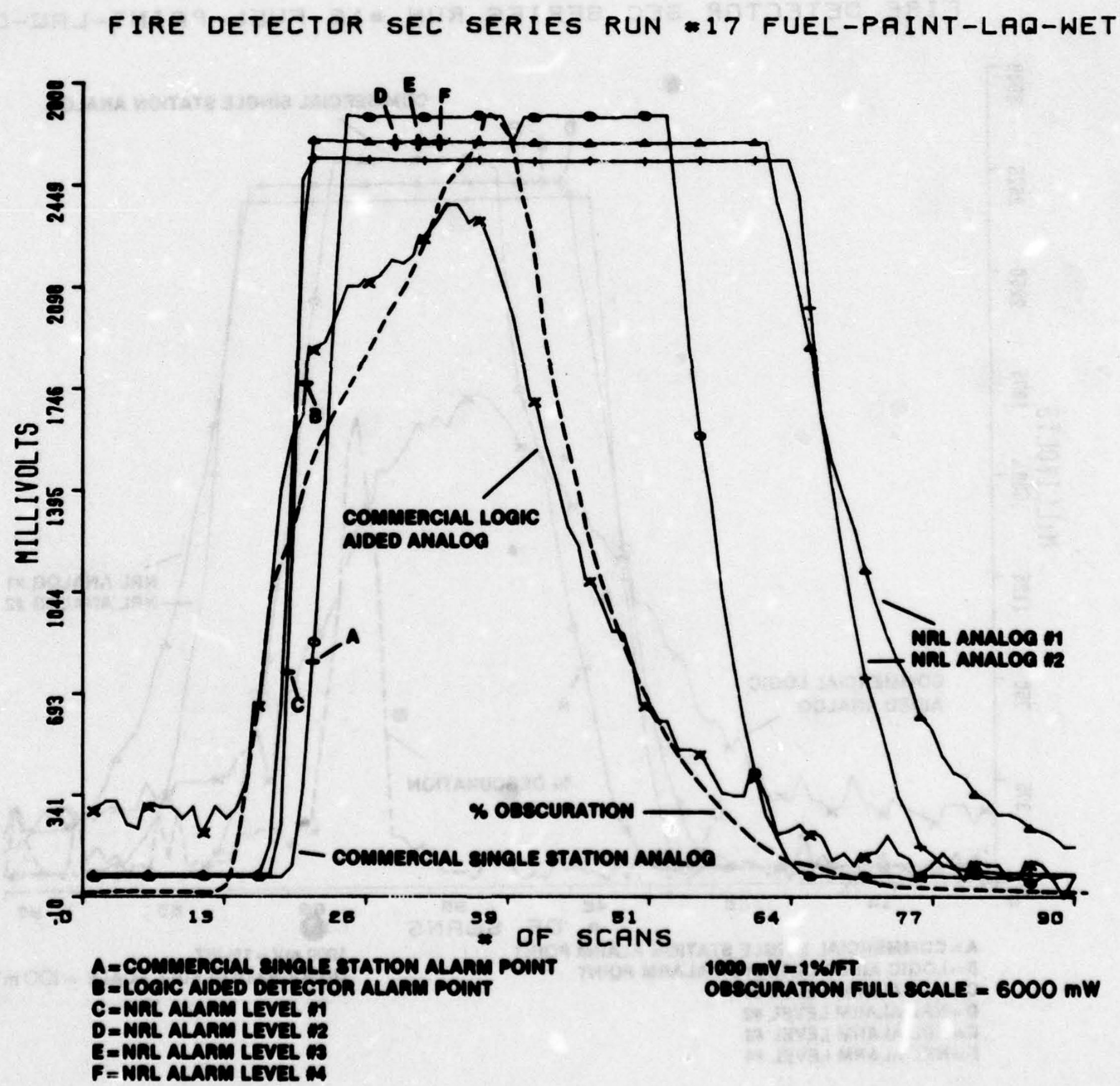

FIRE DETECTOR SEC SERIES RUN #13 FUEL SMOLD. PAPER
MILLIVOLTS
3000
2625
2250
1875
1500
1125
750
375
0
53
105
158
210
263
315
368
OF SCANS
NRL ANALOG #1
NRL ANALOG #2
F
COMMERCIAL SINGLE STATION ANALOG
E
B
D
A
COMMERCIAL LOGIC AIDED ANALOG
C
% OBSCURATION
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 300 mW

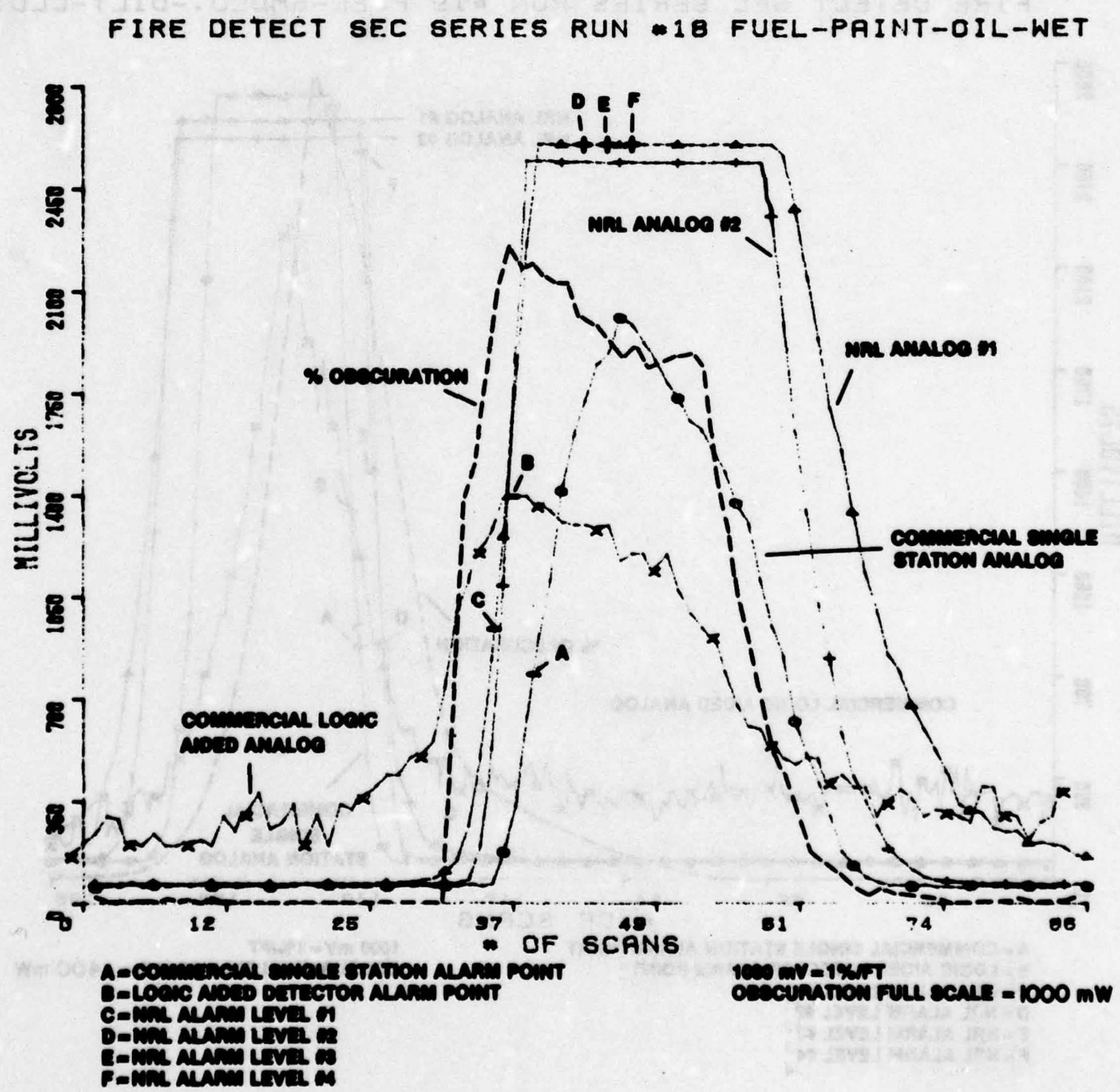
FIRE DETECT SEC SERIES RUN #14 FUEL-SMOLD. URETHANE



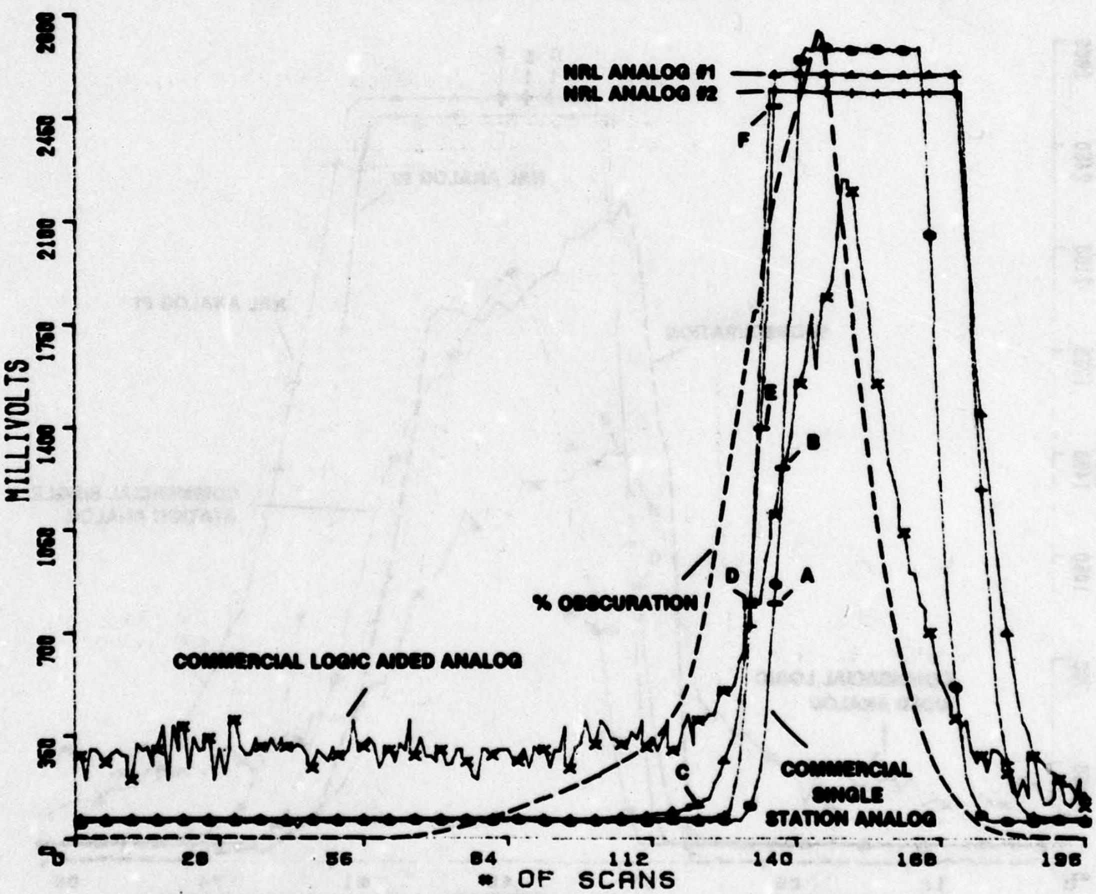

FIRE DETECTOR SEC SERIES RUN #15 FUEL-MAG TAPE
MILLIVOLTS
OF SCANS
NRL ANALOG #1
NRL ANALOG #2
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
% OBSCURATION
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
OBSCURATION FULL SCALE = 100 mW


FIRE DETECTOR SEC SERIES RUN #16 FUEL-PAINT-LAQ-DRY
MILLIVOLTS
3000
2625
2250
1875
1500
1125
750
375
0
14
28
42
55
69
83
97
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
D
E
F
NRL ANALOG #1
NRL ANALOG #2
B
A
C
COMMERCIAL LOGIC
AIDED ANALOG
% OBSCURATION
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 100 mW


FIRE DETECTOR SEC SERIES RUN #17 FUEL-PAINT-LAQ-WET
MILLIVOLTS
OF SCANS
COMMERCIAL LOGIC AIDED ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
COMMERCIAL SINGLE STATION ANALOG
A
B
C
D
E
F
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 6000 mW

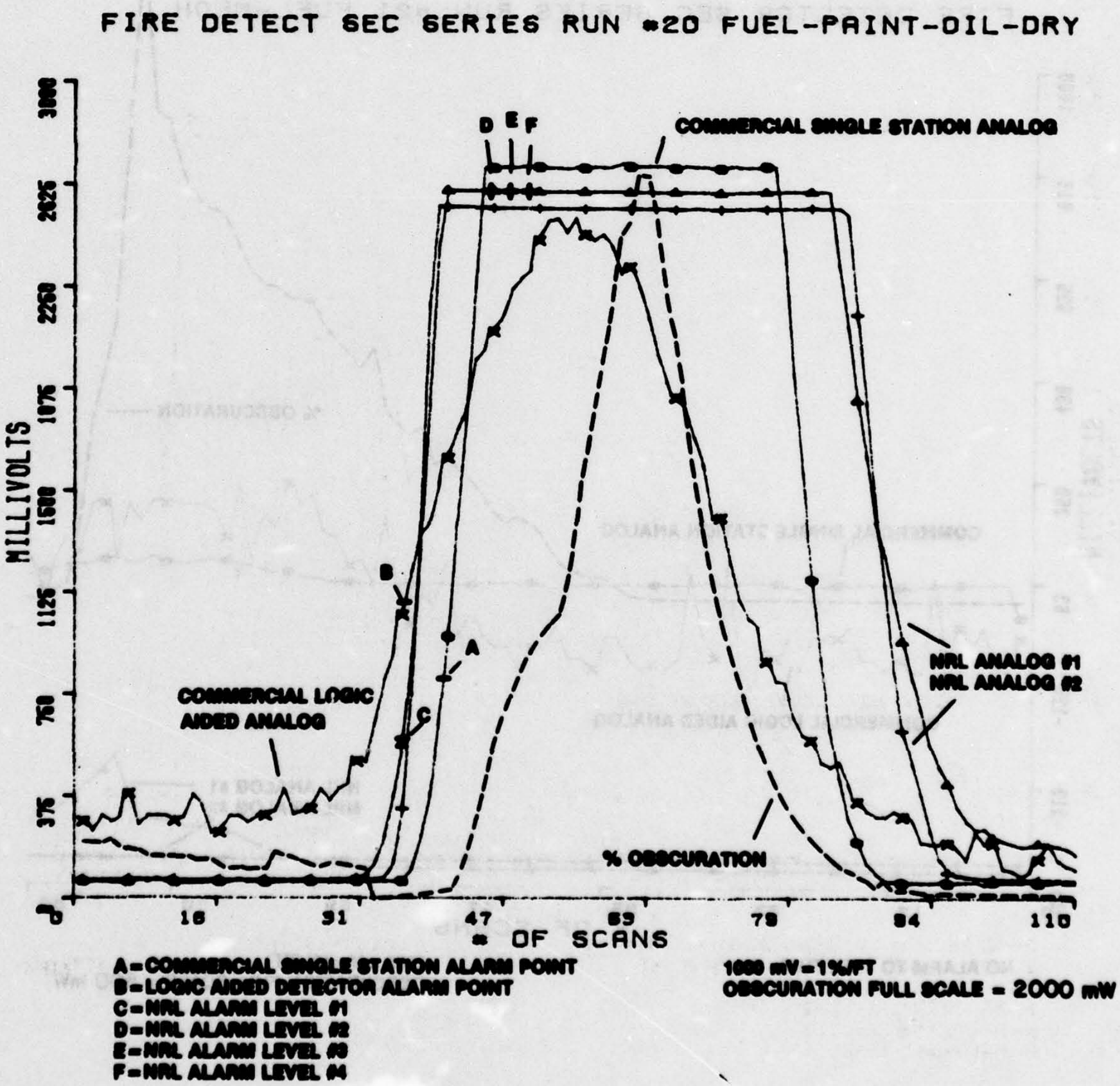

FIRE DETECT SEC SERIES RUN #18 FUEL-PAINT-OIL-WET
MILLIVOLTS
OF SCANS
D E F
NRL ANALOG #2
NRL ANALOG #1
% OBSCURATION
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
A
B
C
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 1000 mW

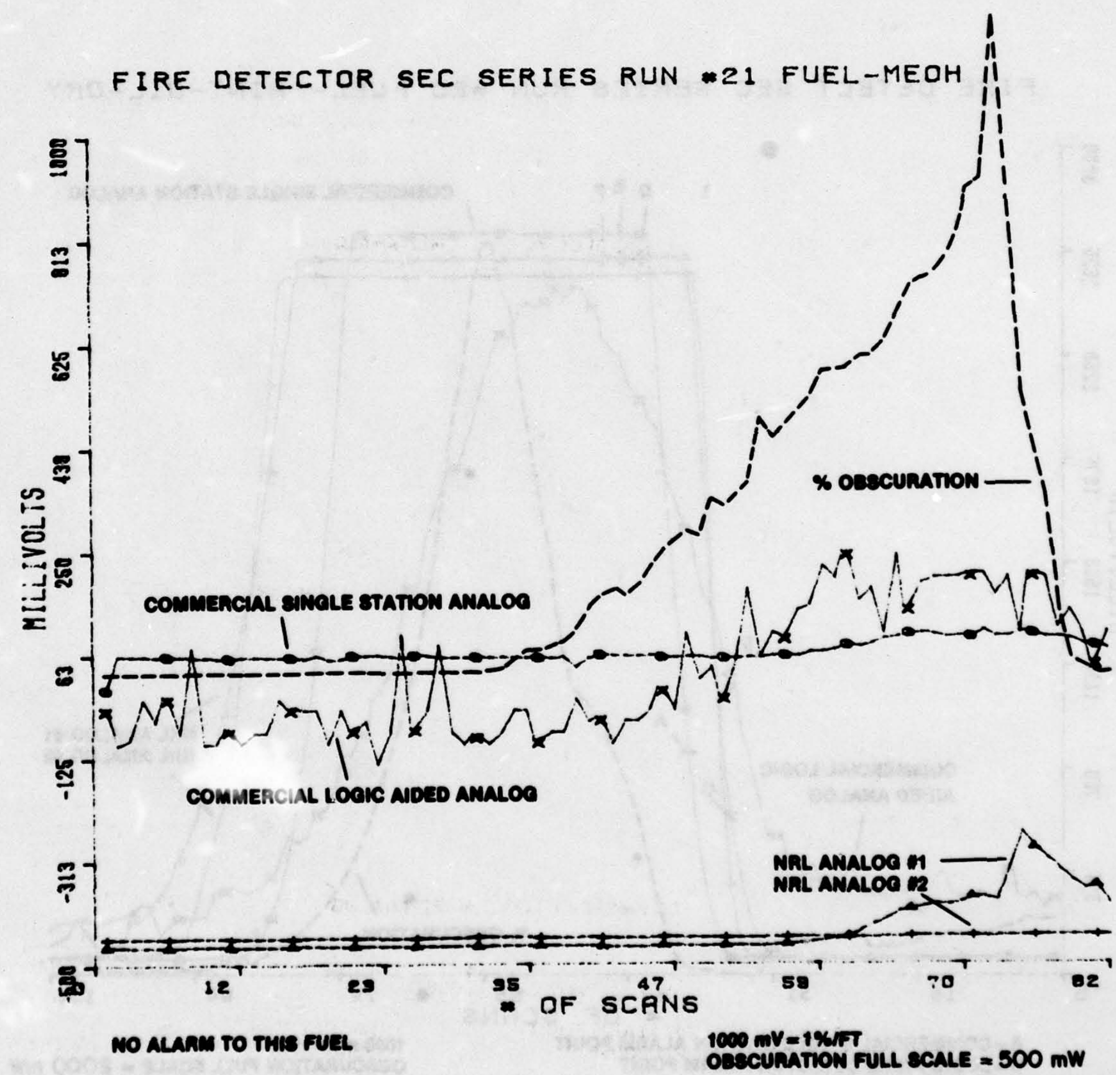
FIRE DETECT SEC SERIES RUN #19 FUEL-SMOLD.-OILY-CLOTH

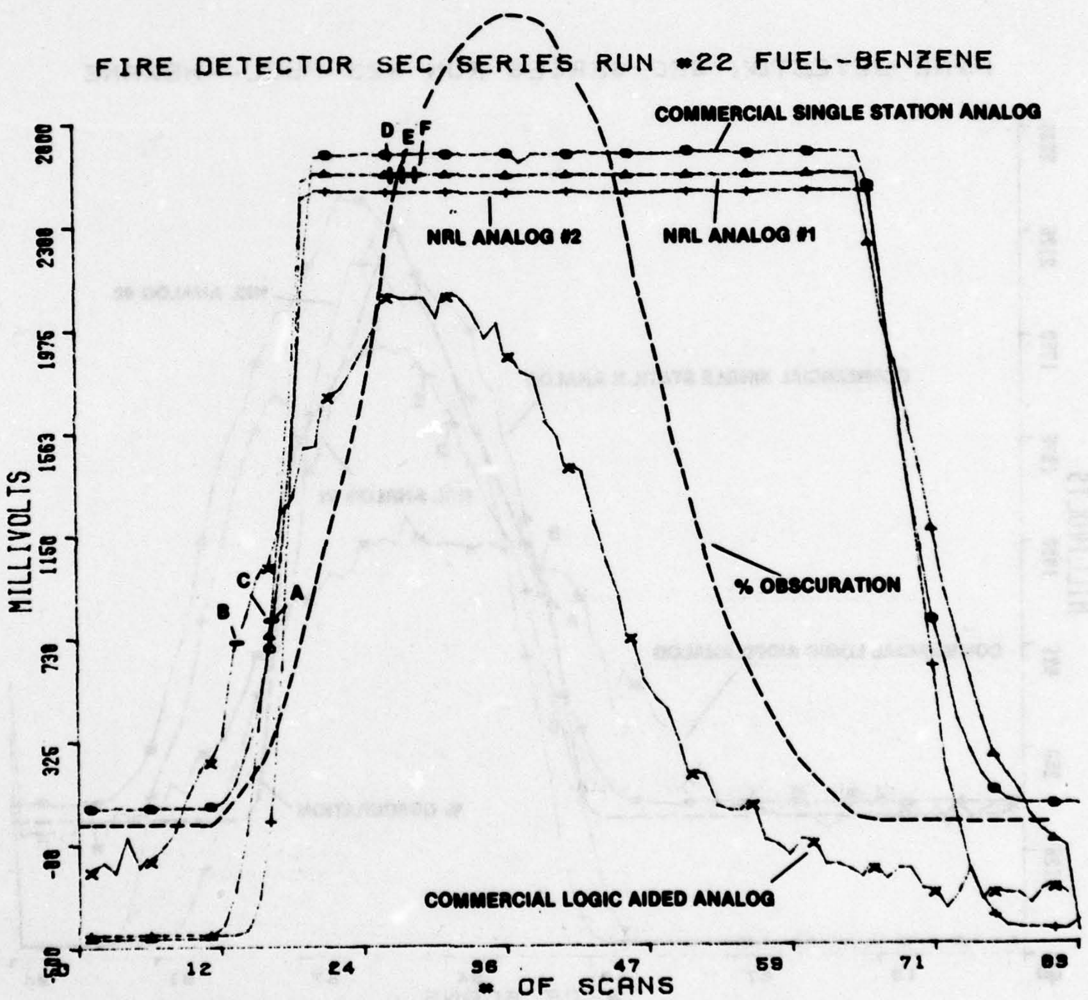


A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

1000 mV=1%/FT
OBSCURATION FULL SCALE = 1400 mW

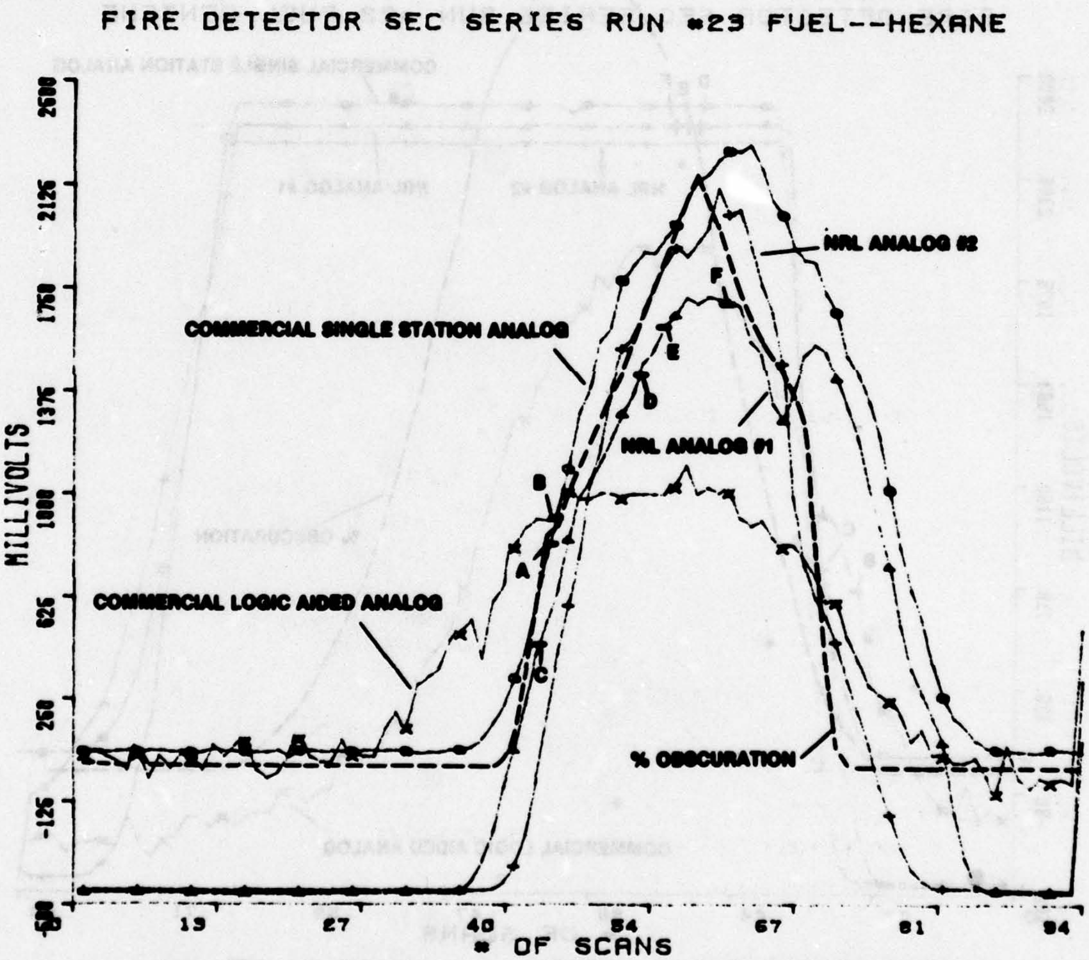

FIRE DETECT SEC SERIES RUN #20 FUEL-PAINT-OIL-DRY
MILLIVOLTS
OF SCANS
0
16
31
47
63
79
94
110
375
750
1125
1500
1875
2250
2625
3000
D E F
COMMERCIAL SINGLE STATION ANALOG
B
A
C
COMMERCIAL LOGIC AIDED ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 2000 mW


FIRE DETECTOR SEC SERIES RUN #21 FUEL-MEOH
MILLIVOLTS
1000
813
625
438
250
63
-125
-313
-500
12
23
35
47
59
70
82
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
NO ALARM TO THIS FUEL
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW



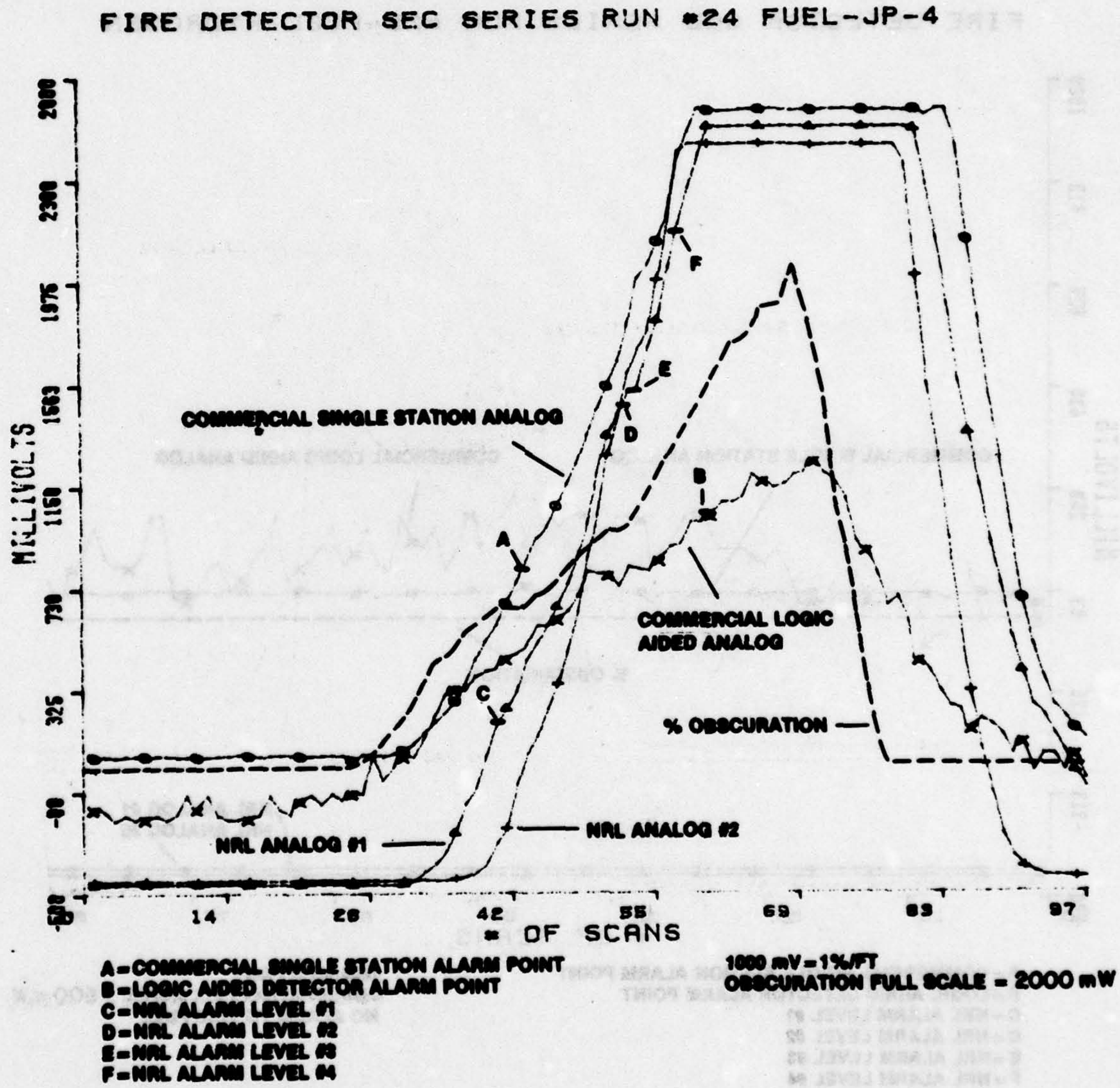
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1300 mW

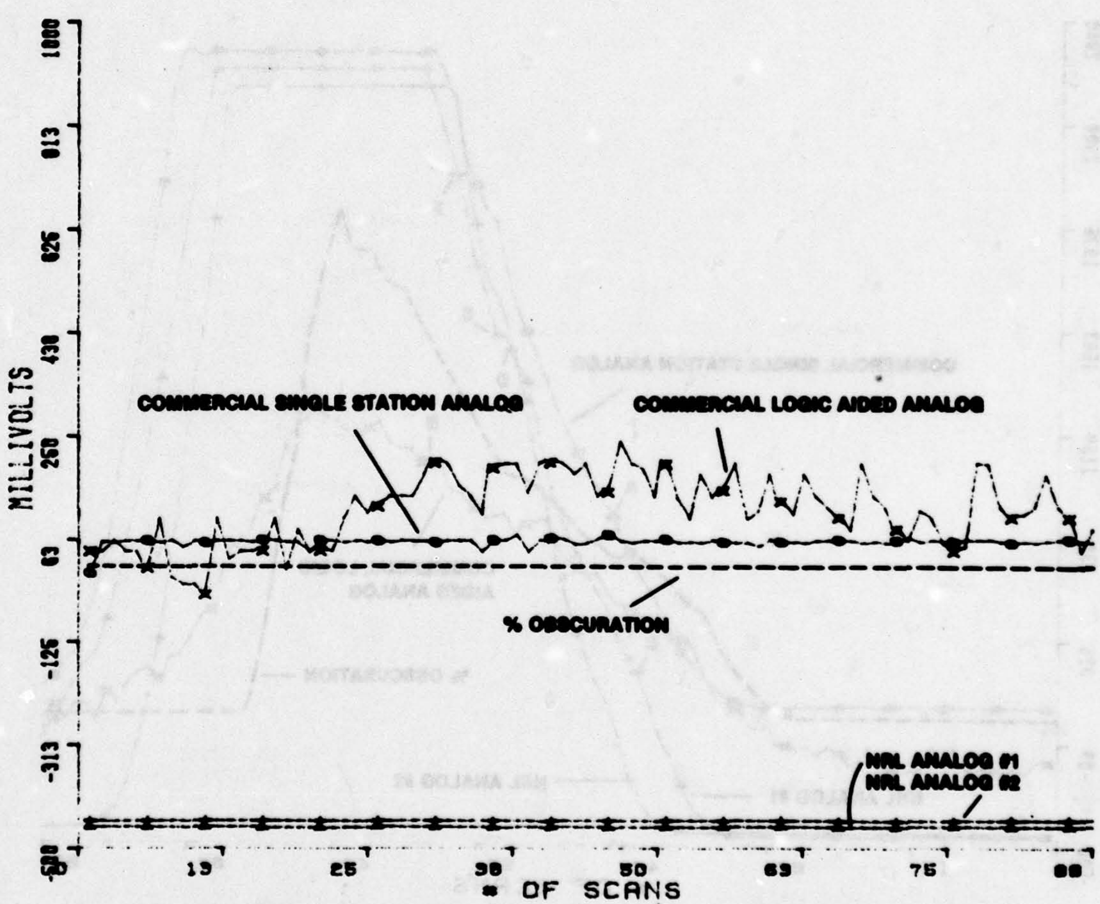


A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1000 mW


FIRE DETECTOR SEC SERIES RUN #24 FUEL-JP-4
MILLIVOLTS
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
A
B
C
D
E
F
14
28
42
55
69
83
97
325
730
1150
1563
1975
2000
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 2000 mW

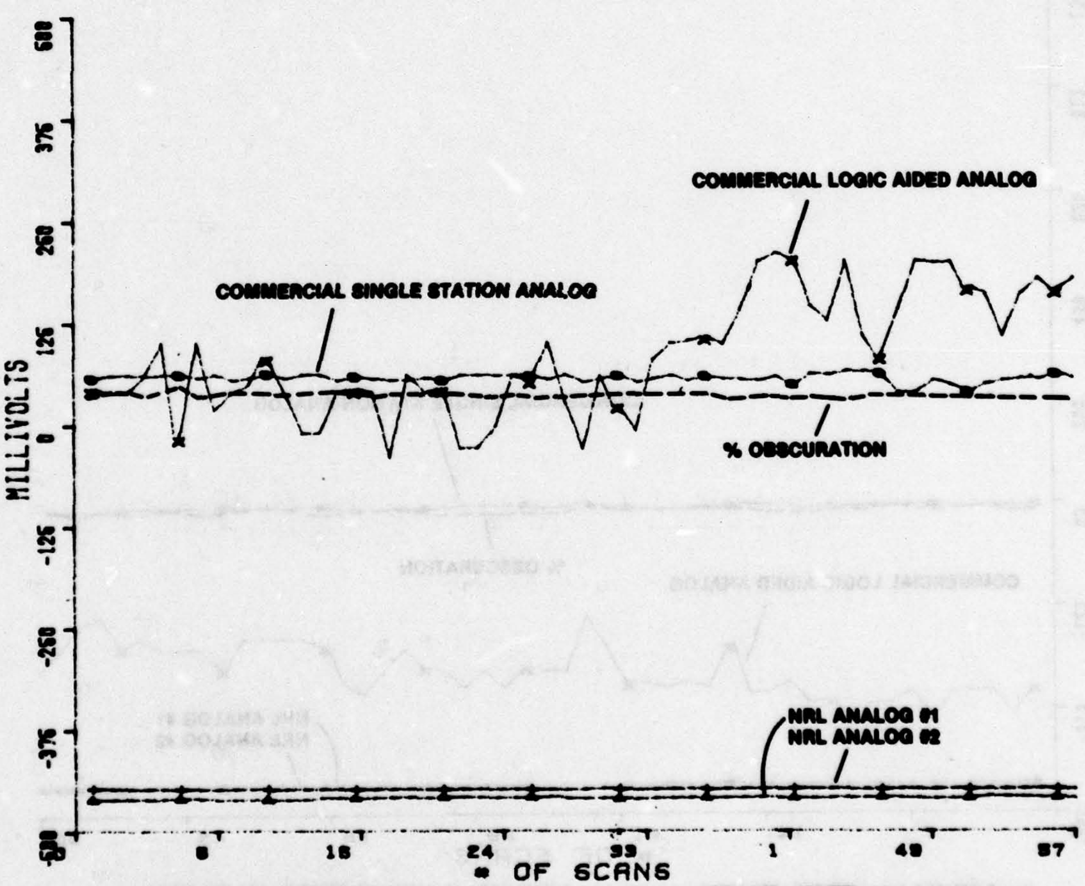
FIRE DETECTOR SEC SERIES RUN #25-FUEL-HYDROGEN



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

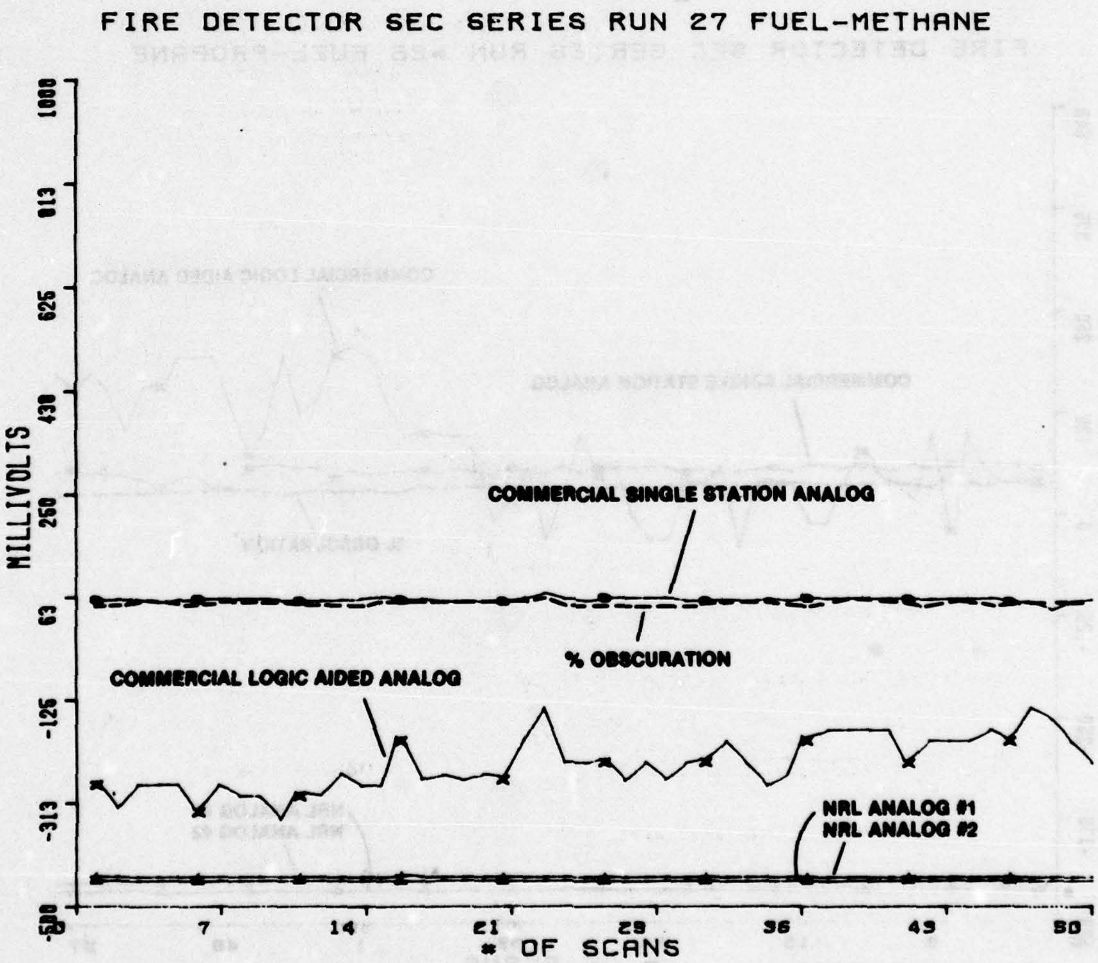
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW
NO ALARM TO THIS FUEL

FIRE DETECTOR SEC SERIES RUN #26 FUEL-PROPANE



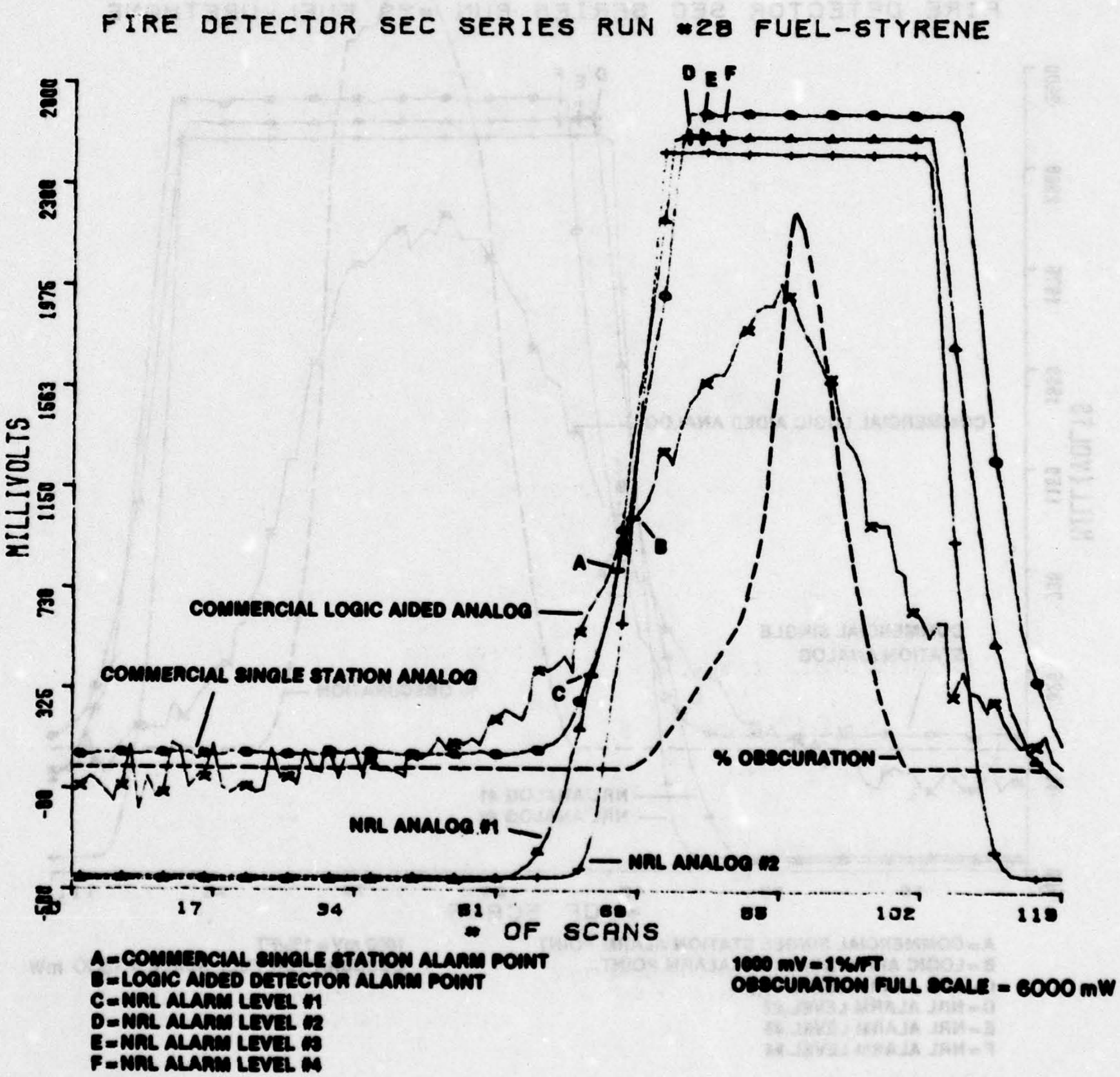
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

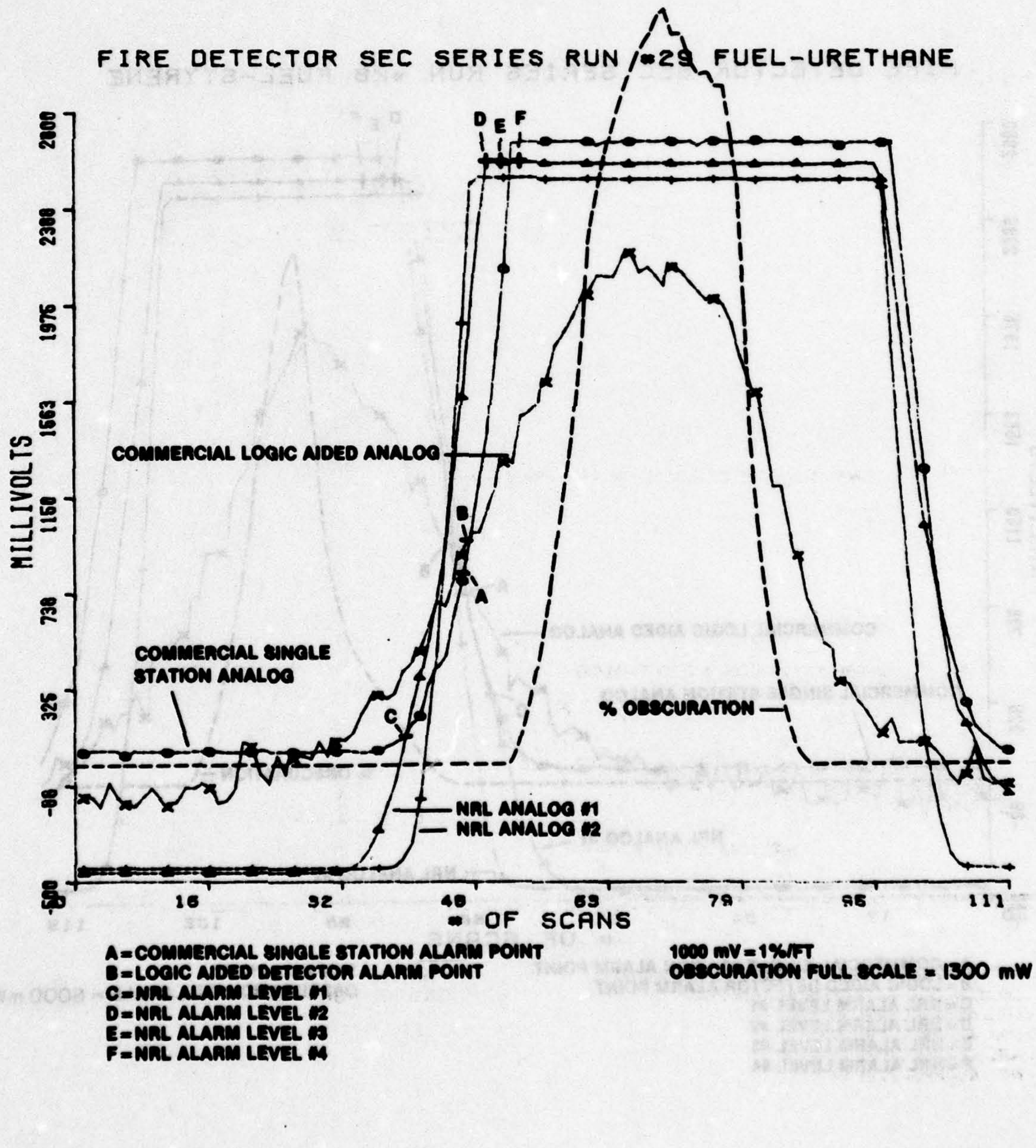
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 200 mW
NO ALARM TO THIS FUEL

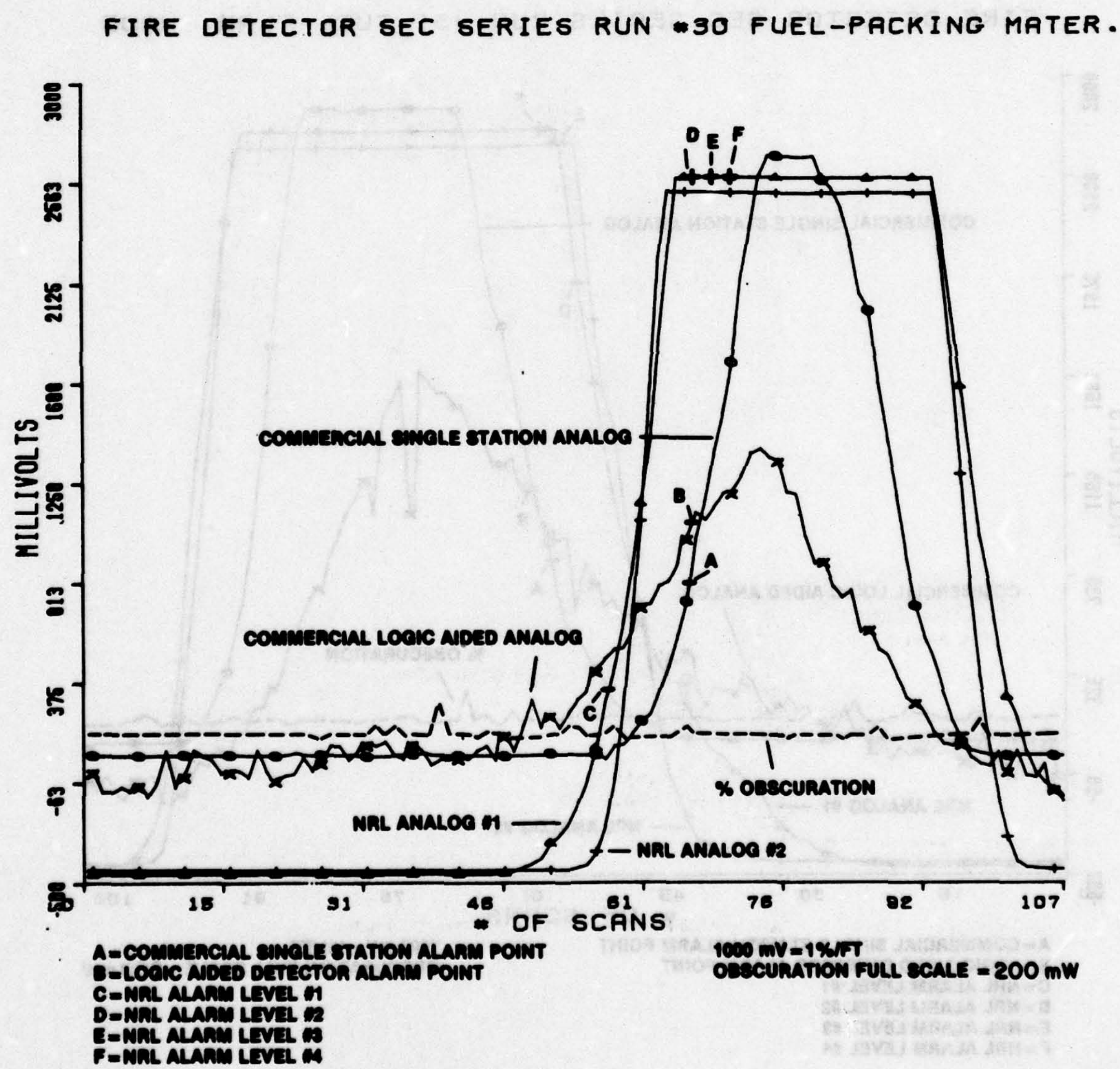


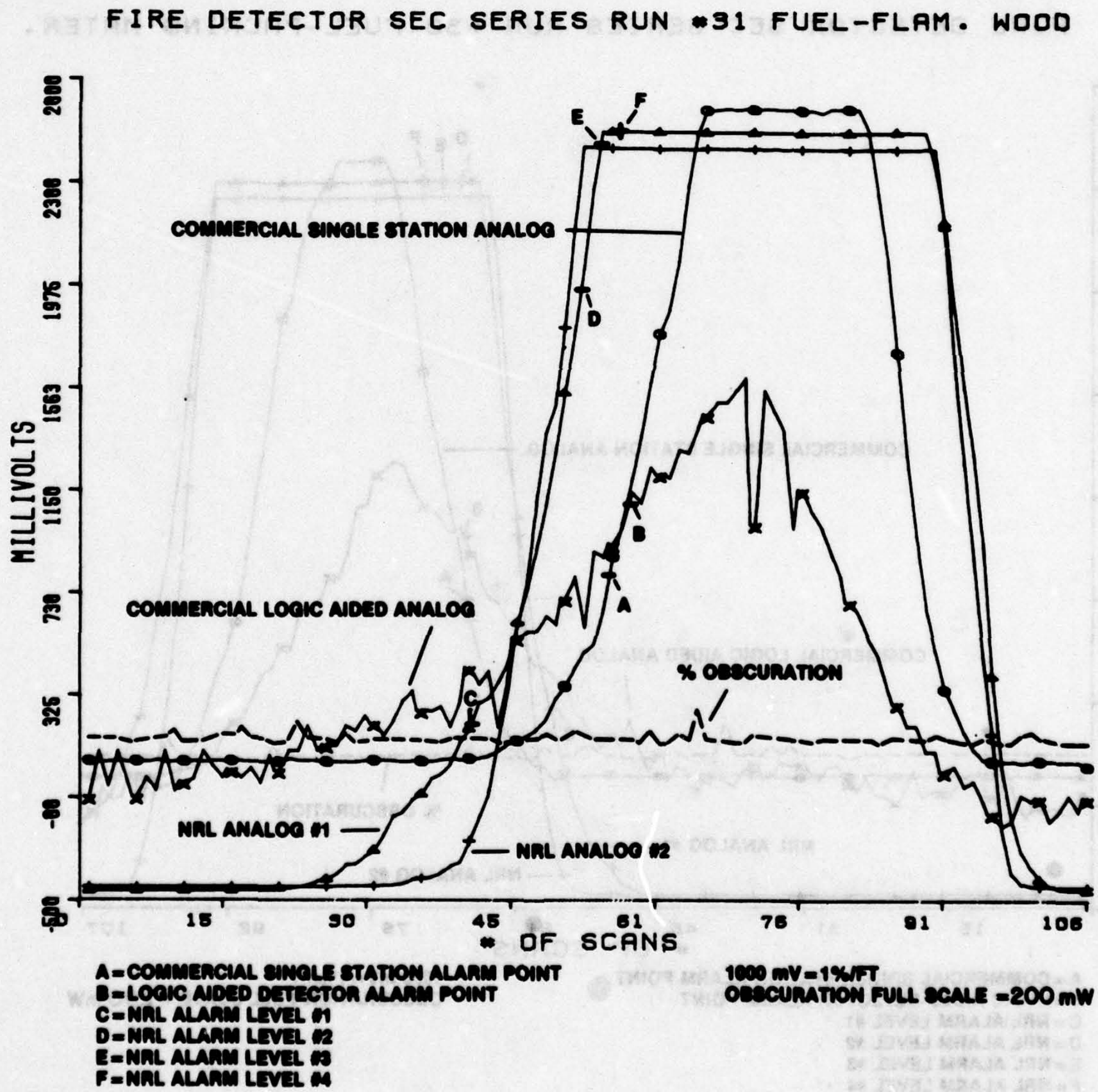
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

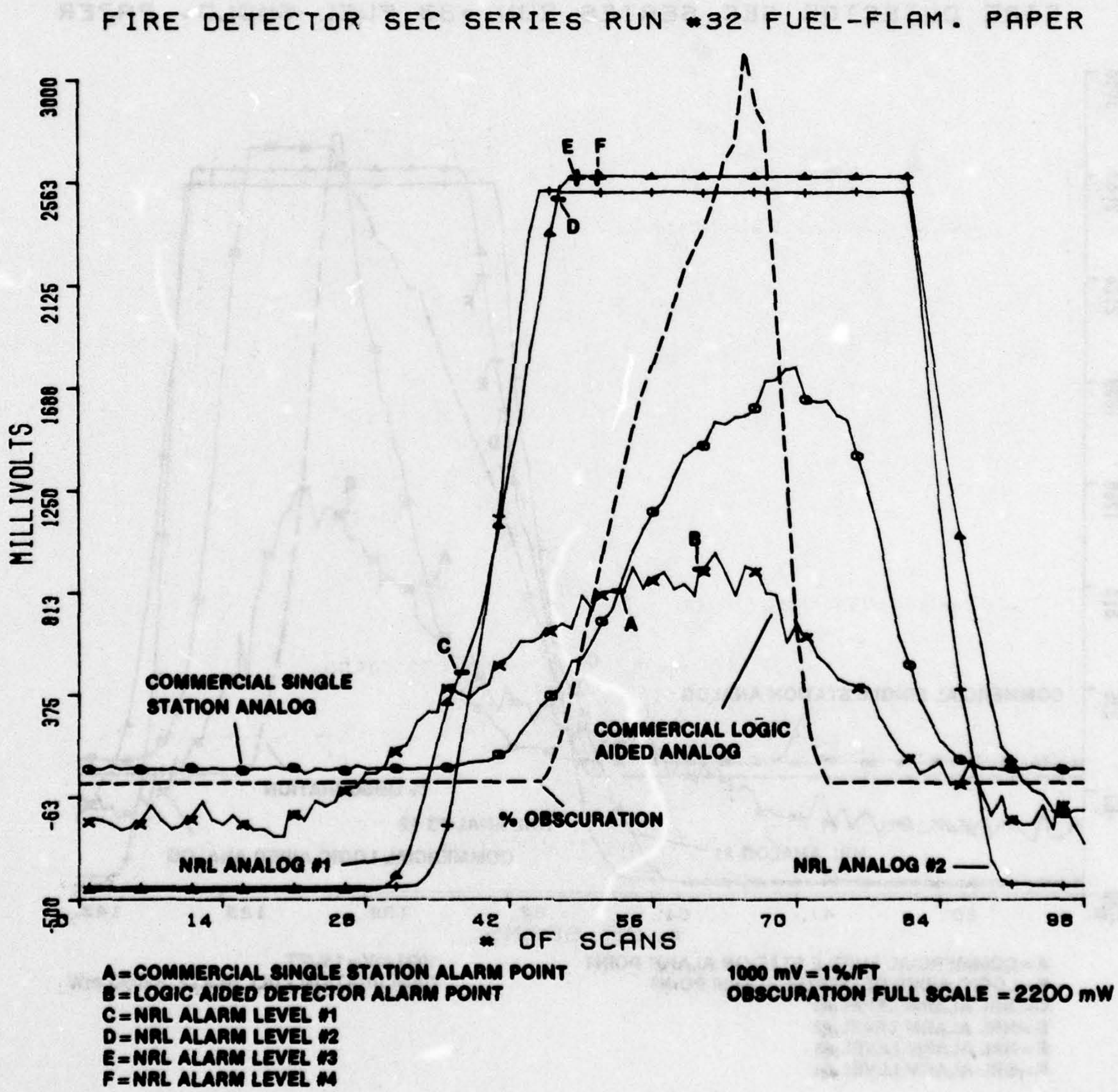
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 200 mW
• NO ALARM TO THIS FUEL

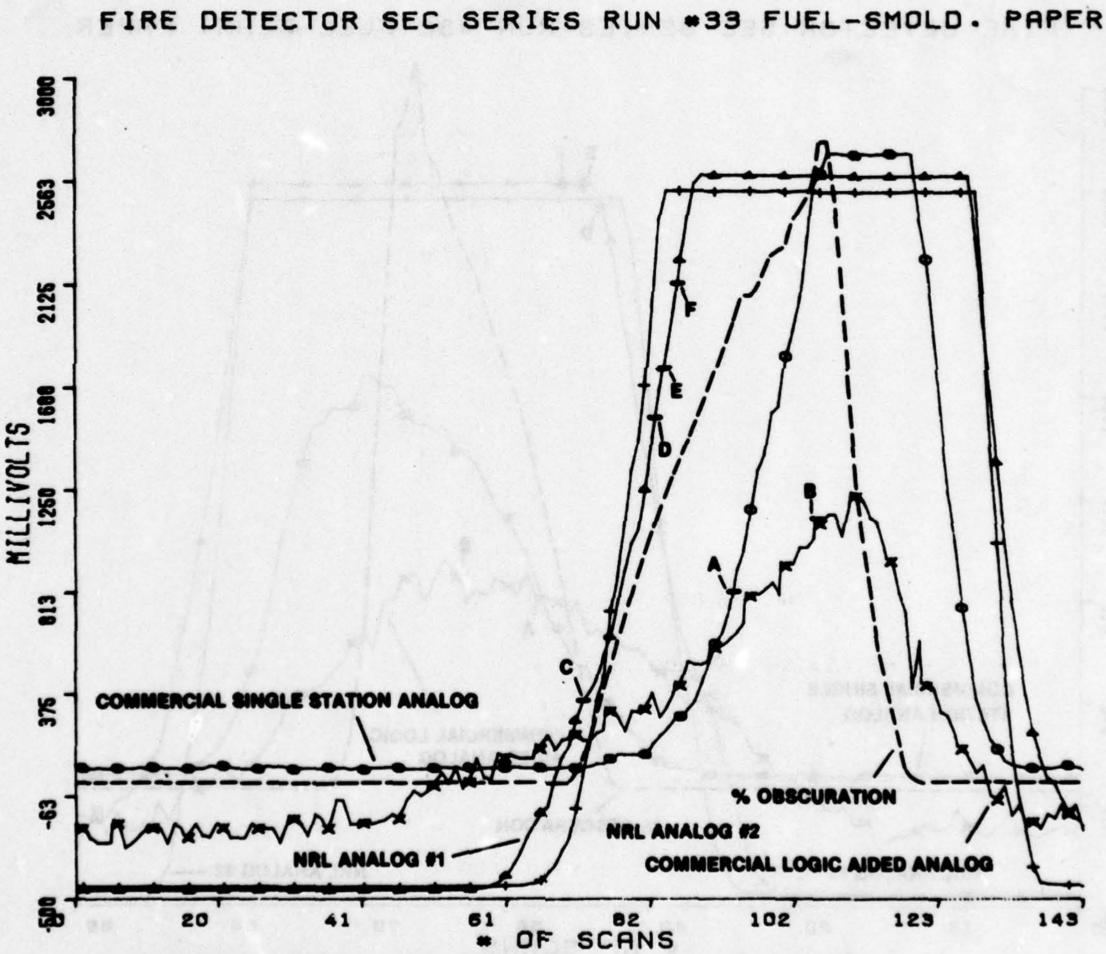

FIRE DETECTOR SEC SERIES RUN #28 FUEL-STYRENE
MILLIVOLTS
2800
2388
1976
1563
1150
738
325
-88
-500
17
34
51
68
85
102
119
OF SCANS
D
E
F
A
B
C
COMMERCIAL LOGIC AIDED ANALOG
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 6000 mW


FIRE DETECTOR SEC SERIES RUN #29 FUEL-URETHANE
MILLIVOLTS
2800
2388
1976
1563
1150
738
325
-88
-500
0
16
32
48
63
79
95
111
OF SCANS
D
E
F
COMMERCIAL LOGIC AIDED ANALOG
B
A
COMMERCIAL SINGLE STATION ANALOG
C
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1300 mW


FIRE DETECTOR SEC SERIES RUN #30 FUEL-PACKING MATER.
MILLIVOLTS
3000
2563
2126
1688
1250
813
375
-63
-500
0
15
31
46
61
76
92
107
OF SCANS
D
E
F
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
B
A
C
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 200 mW

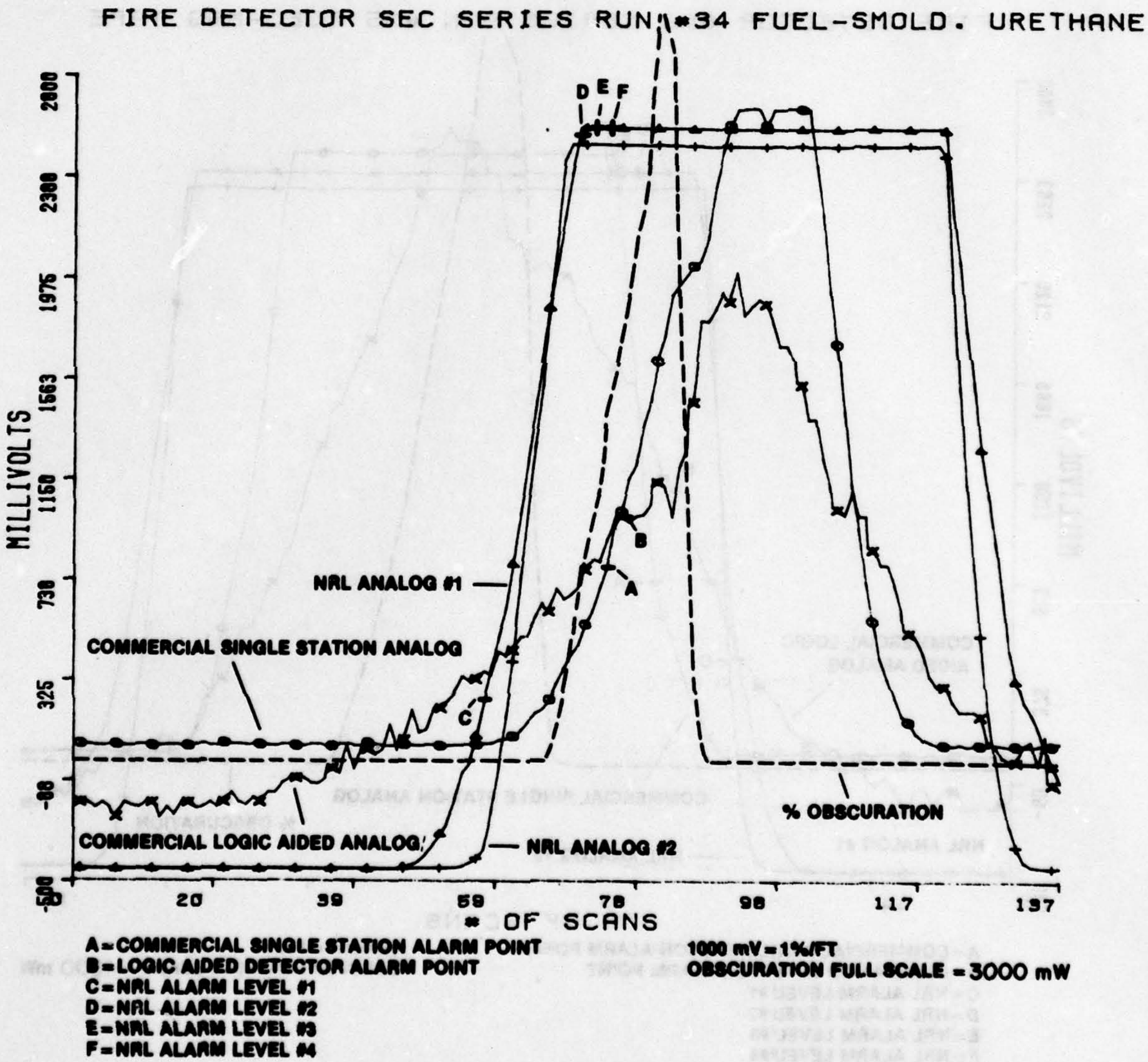

FIRE DETECTOR SEC SERIES RUN #31 FUEL-FLAM. WOOD
MILLIVOLTS
2800
2388
1976
1563
1150
738
326
-88
-500
0
15
30
45
61
76
91
106
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
A
B
C
D
E
F
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1600 mV=1%/FT
OBSCURATION FULL SCALE =200 mW

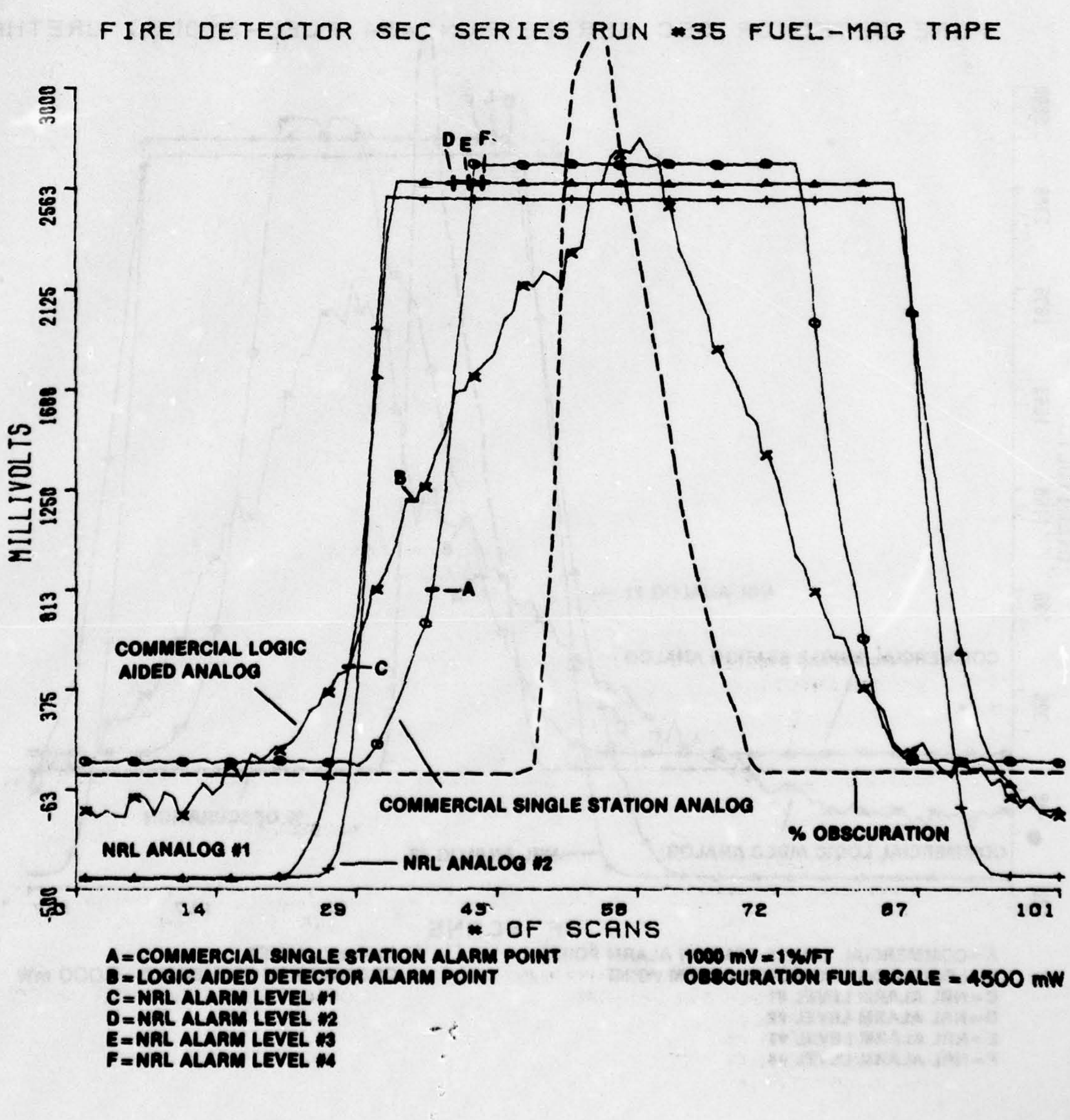

FIRE DETECTOR SEC SERIES RUN #32 FUEL-FLAM. PAPER
MILLIVOLTS
3000
2563
2125
1688
1250
813
375
-63
-500
0
14
28
42
56
70
84
98
OF SCANS
E
F
D
C
B
A
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 2200 mW

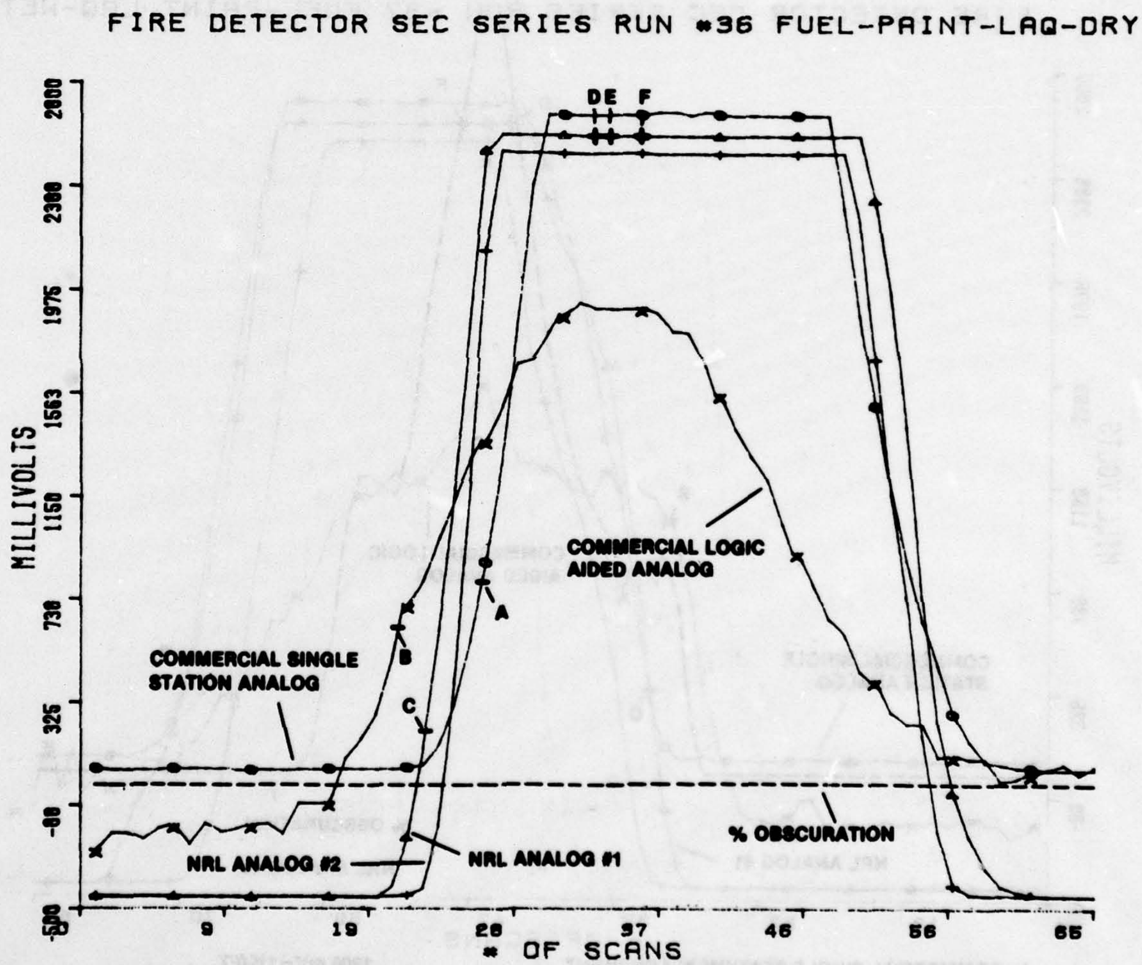


A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 850 mW

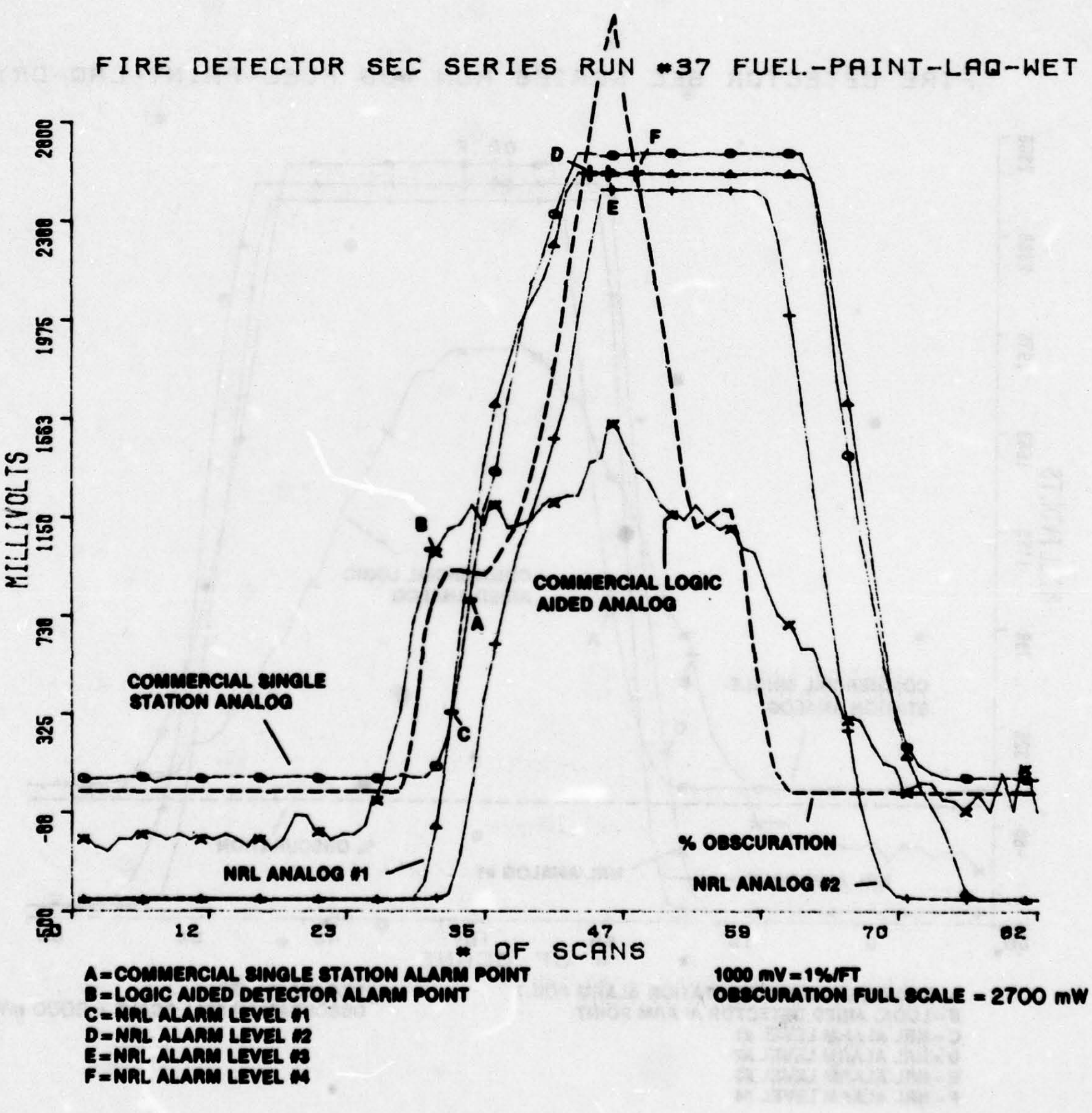

FIRE DETECTOR SEC SERIES RUN #34 FUEL-SMOLD. URETHANE
MILLIVOLTS
2800
2388
1976
1563
1150
738
325
-88
-500
20
39
59
78
98
117
137
OF SCANS
D E F
A
B
C
NRL ANALOG #1
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
NRL ANALOG #2
% OBSCURATION
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 3000 mW

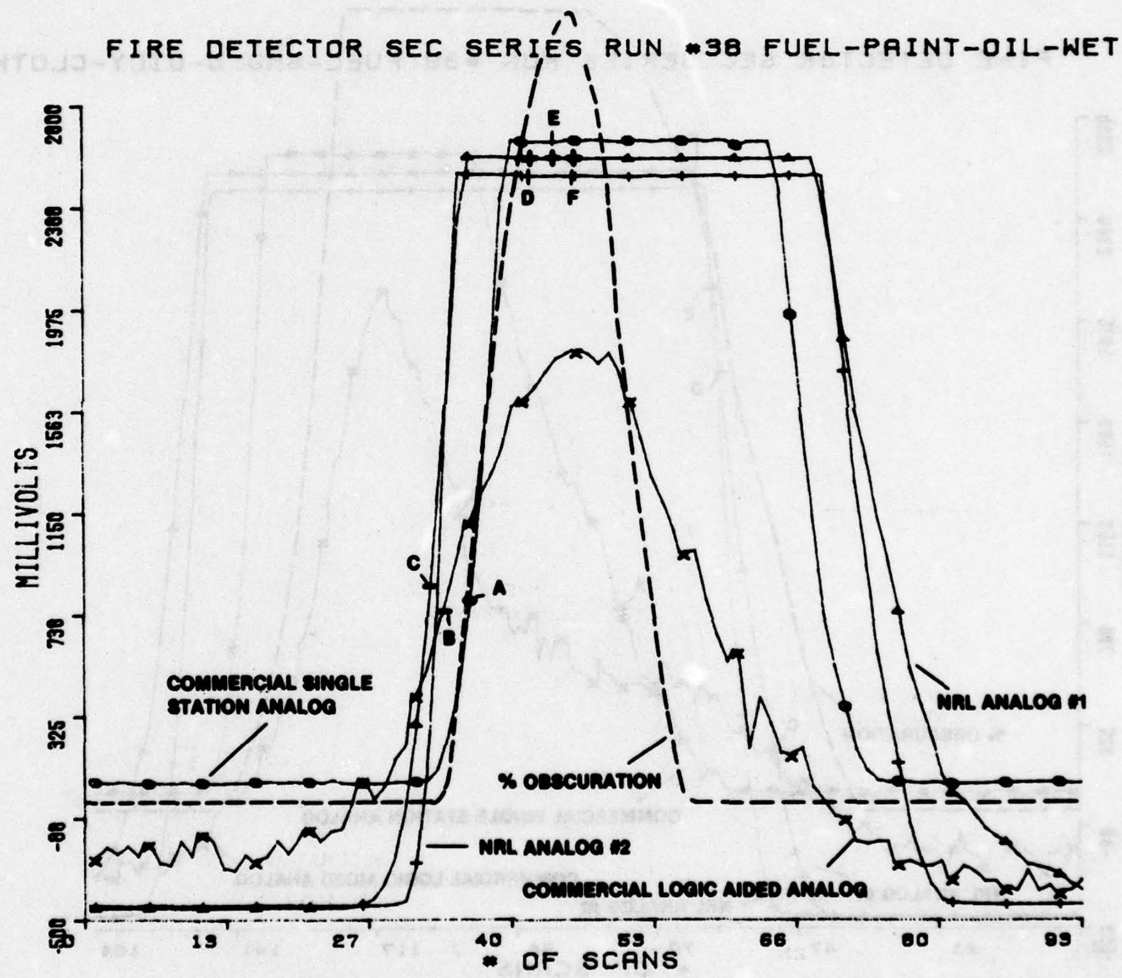

FIRE DETECTOR SEC SERIES RUN #35 FUEL-MAG TAPE
MILLIVOLTS
3000
2563
2125
1688
1250
813
375
-63
-500
0
14
29
43
58
72
87
101
OF SCANS
D
E
F
A
B
C
COMMERCIAL LOGIC AIDED ANALOG
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 4500 mW



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

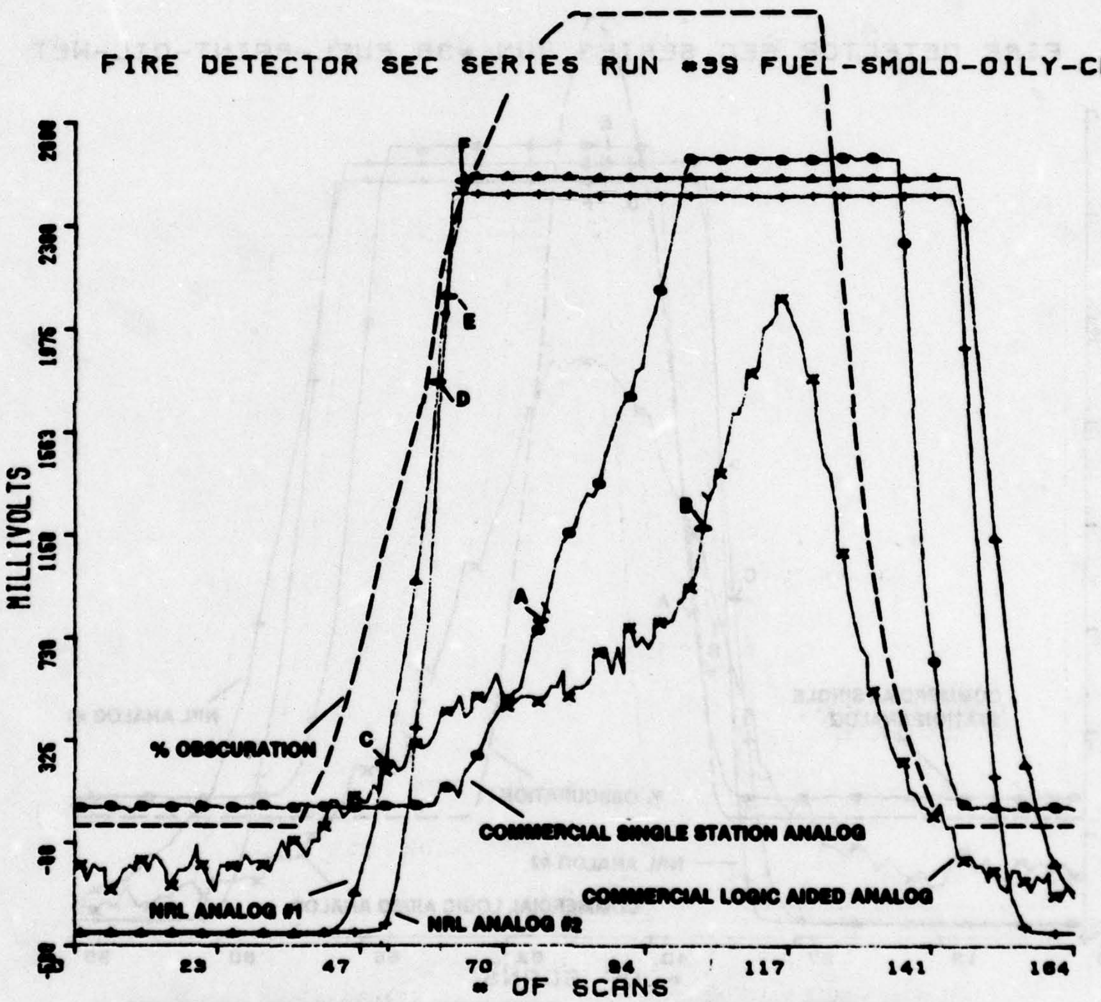
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 2000 mW


FIRE DETECTOR SEC SERIES RUN #37 FUEL-PAINT-LAQ-WET
MILLIVOLTS
2800
2388
1975
1563
1150
738
325
-88
-500
0
12
23
35
47
59
70
82
OF SCANS
A
B
C
D
E
F
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 2700 mW



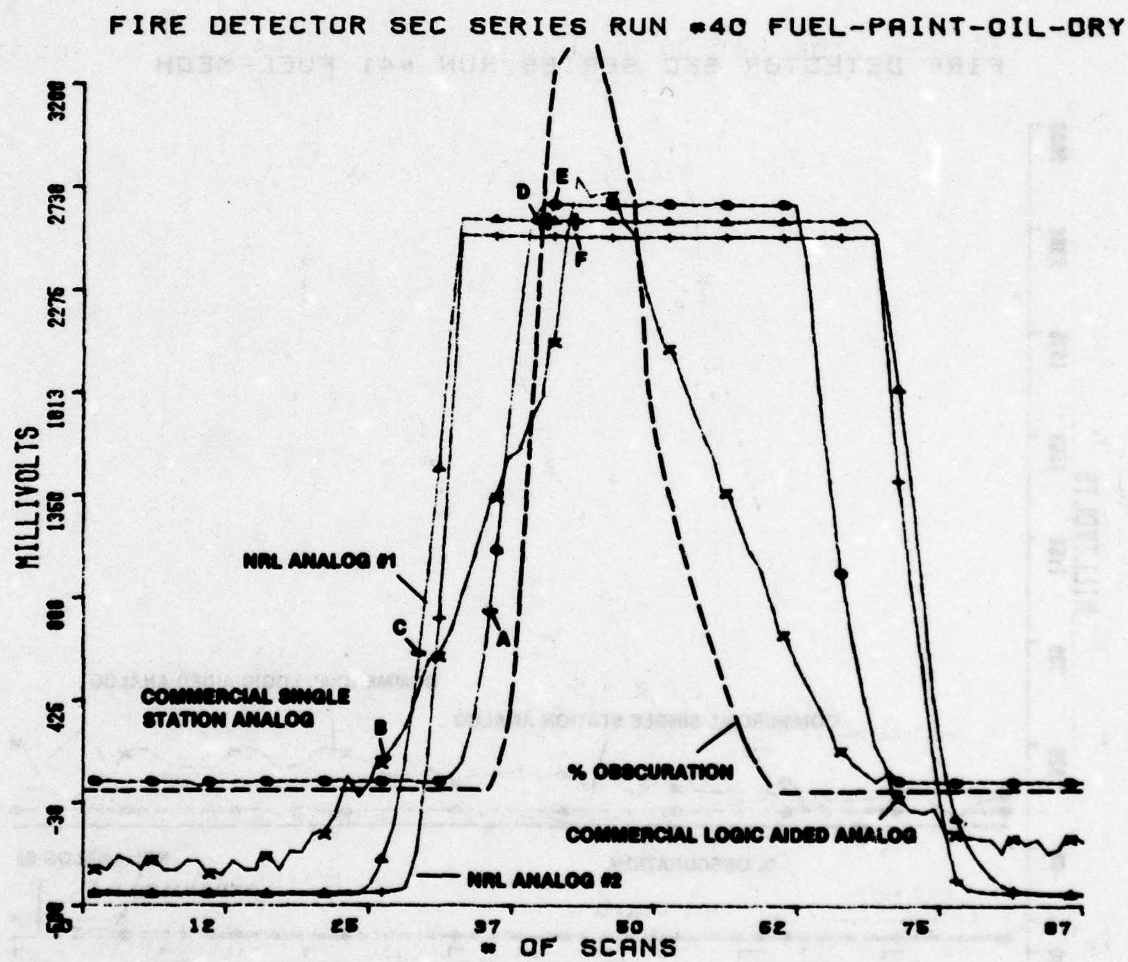
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 5500 mW



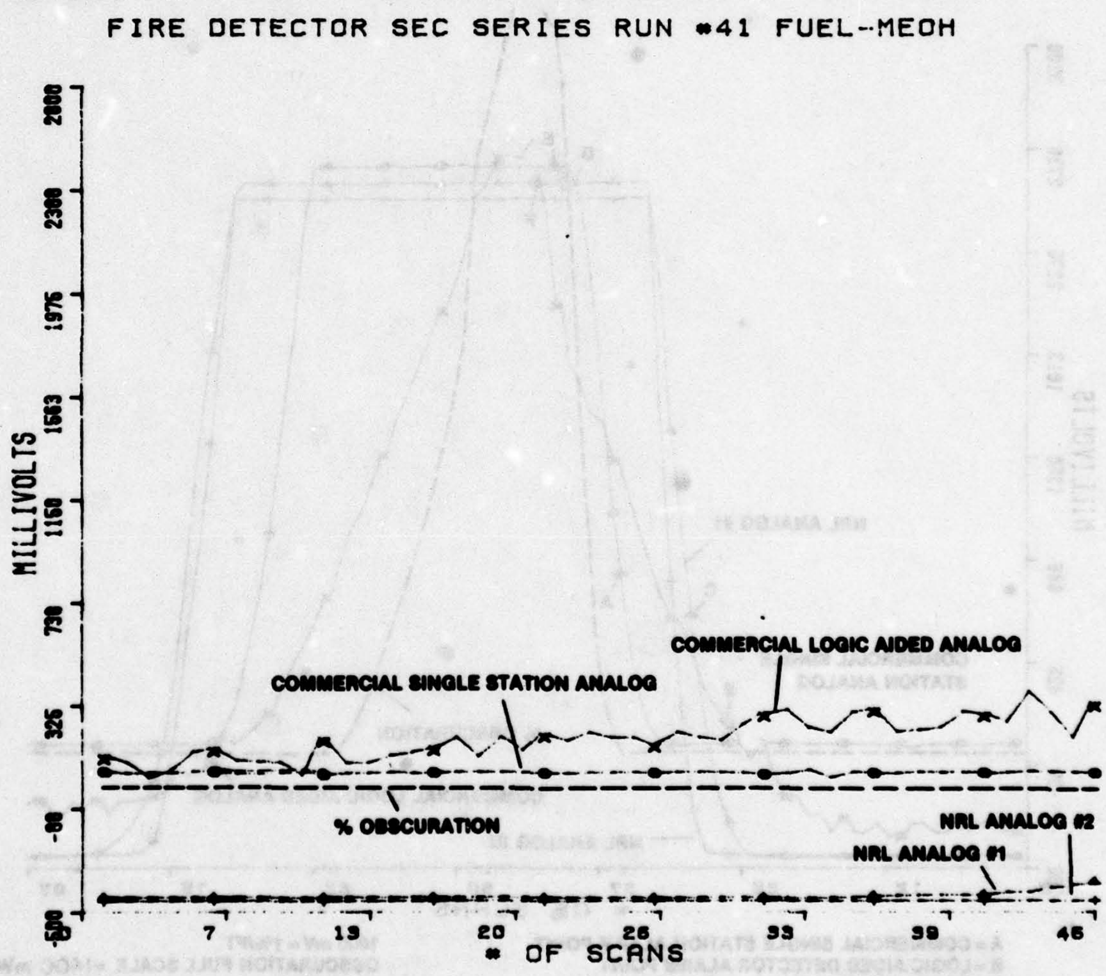
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1400 mW



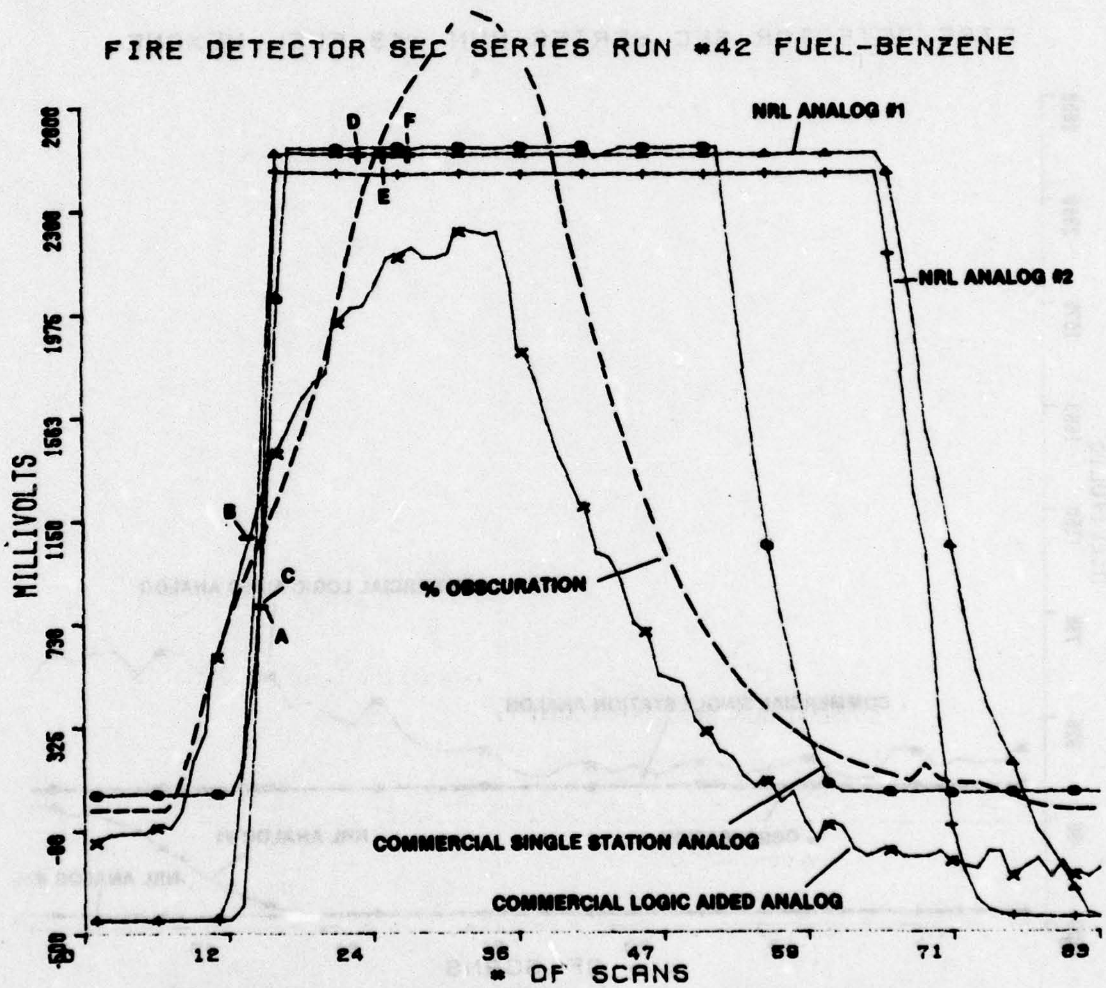
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1400 mW



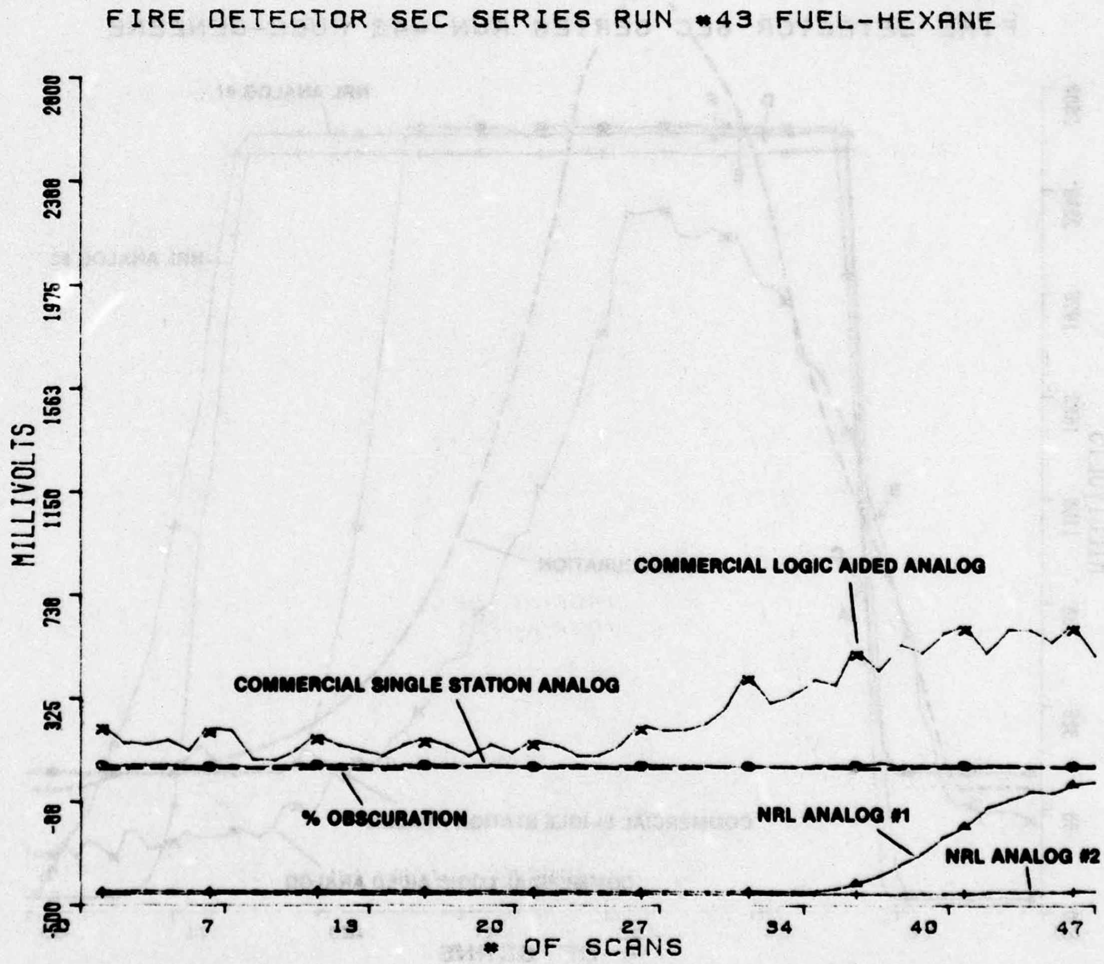
NO ALARM TO THIS FUEL

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1100 mW



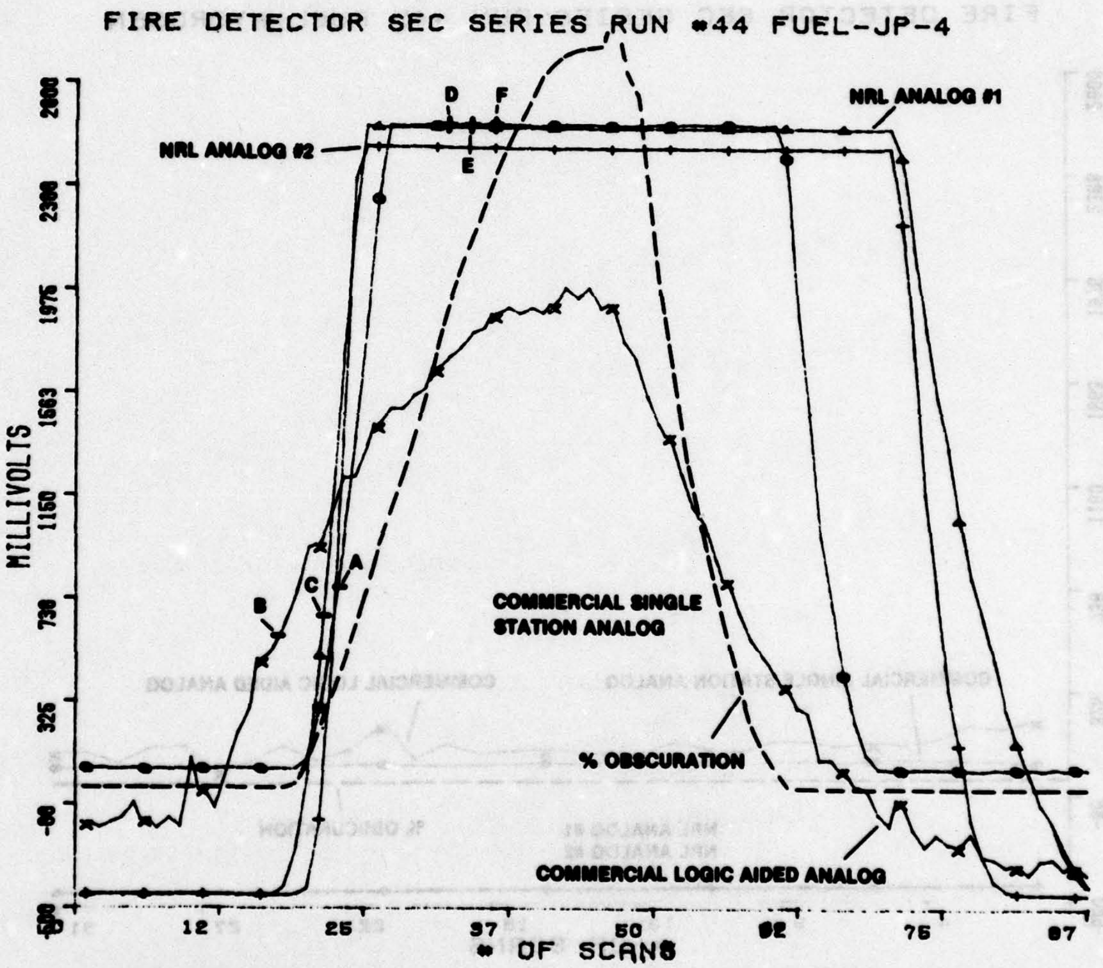
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 800 mW



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

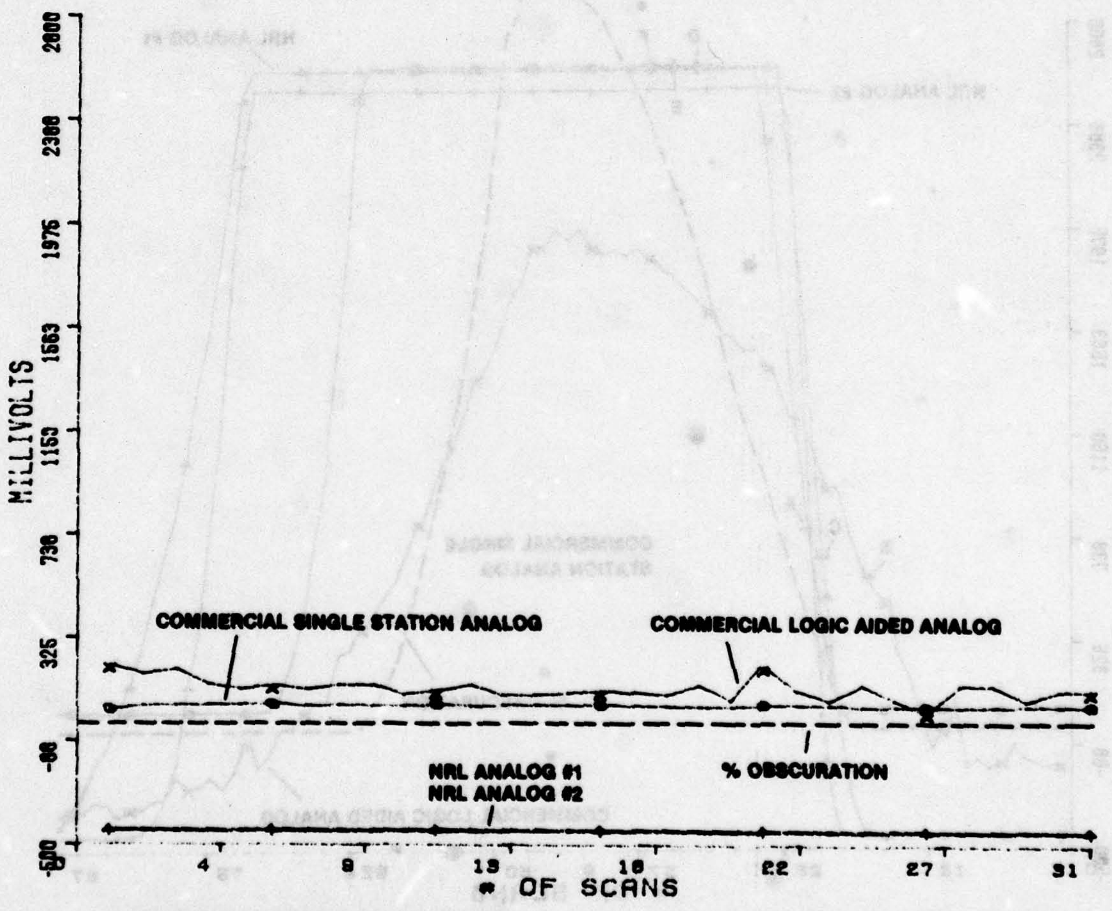
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW
NO ALARM TO THIS FUEL



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

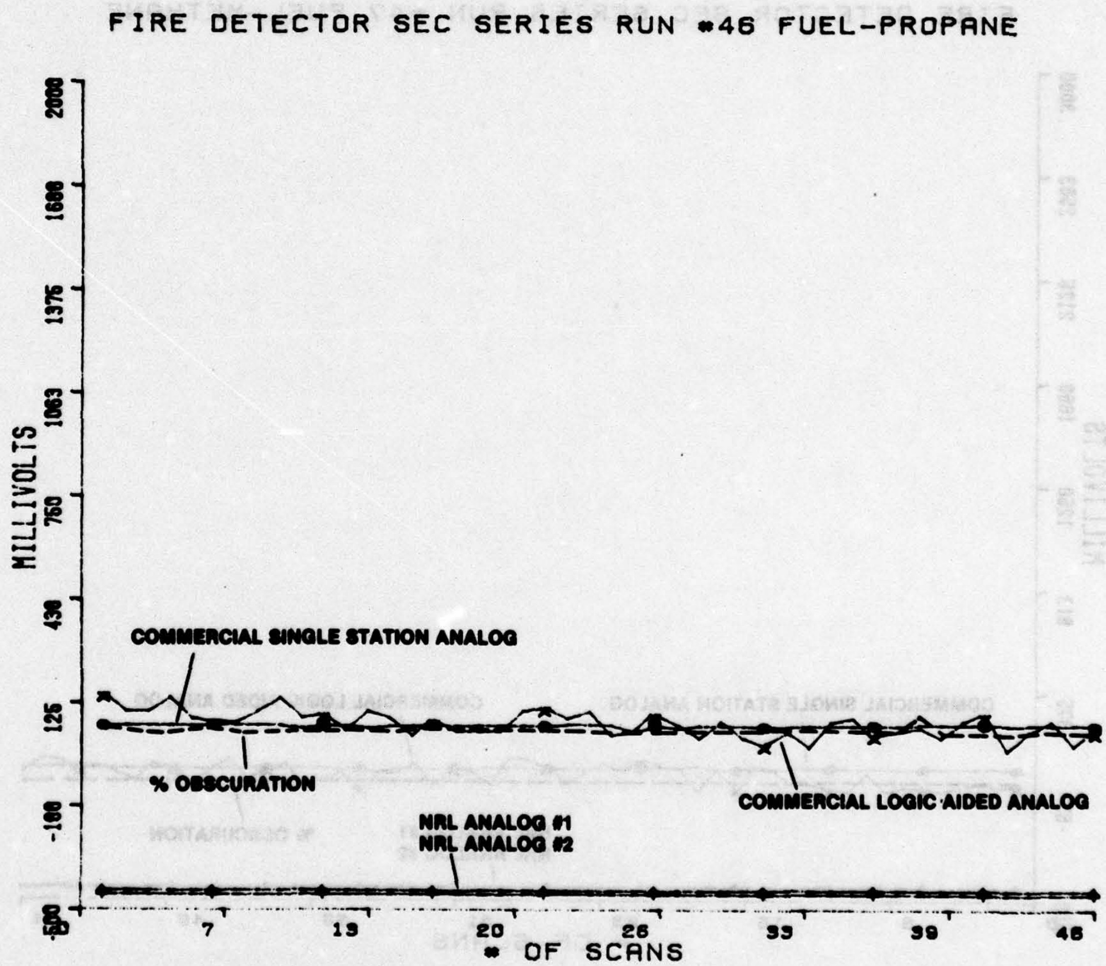
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 2600 mW

FIRE DETECTOR SEC SERIES RUN #45 FUEL-HYDROGEN



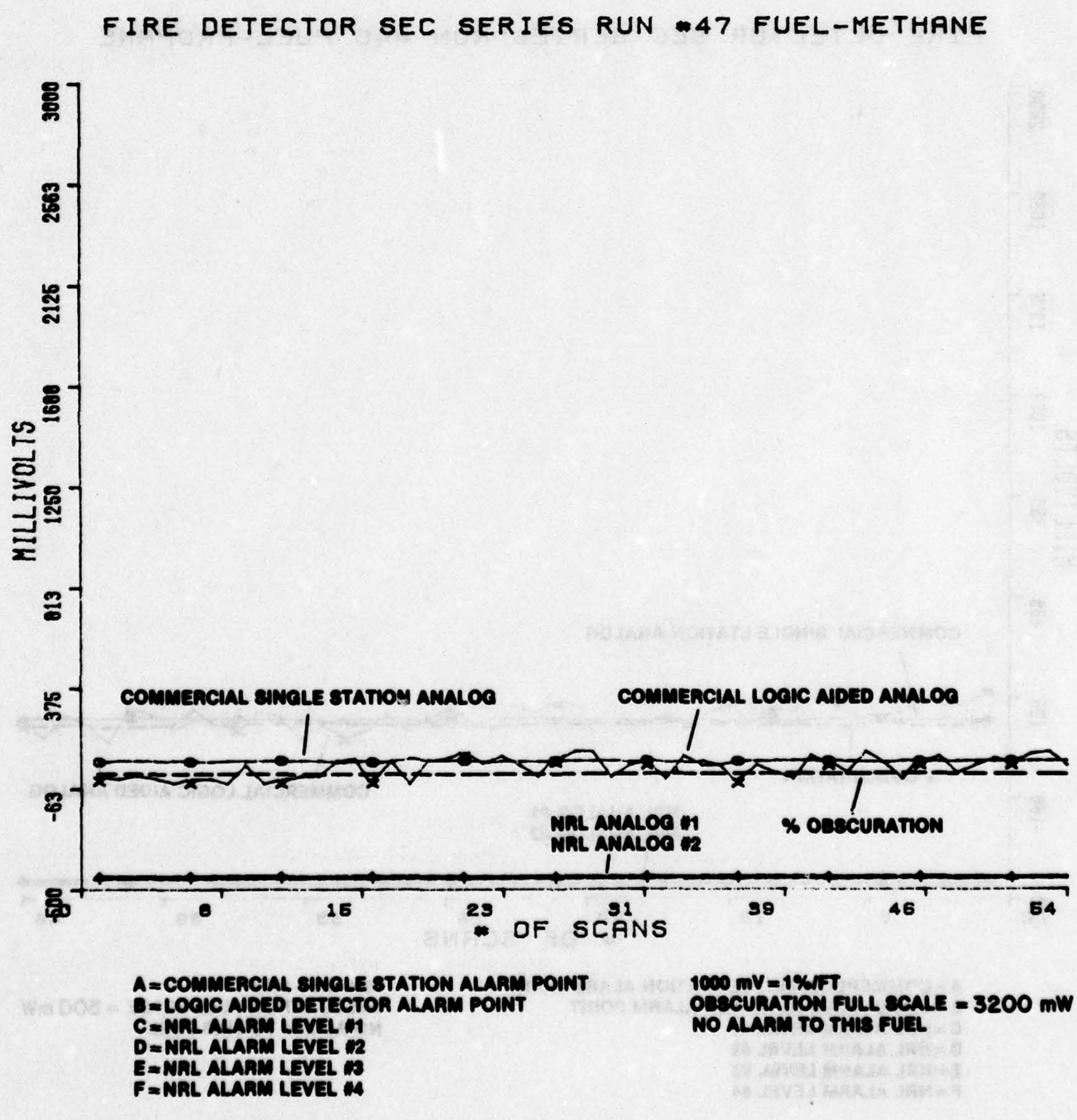
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

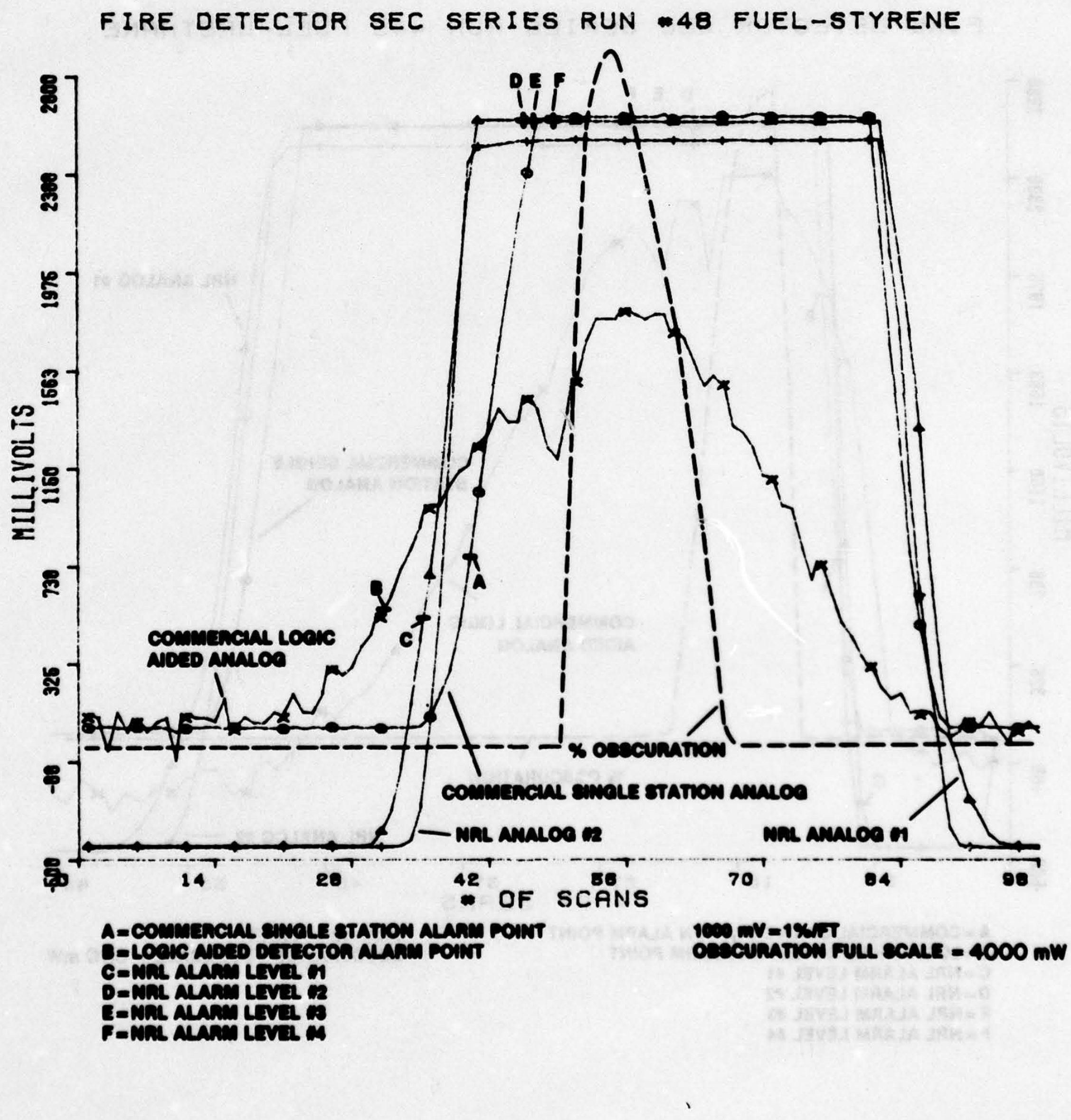
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1500 mW
NO ALARM TO THIS FUEL

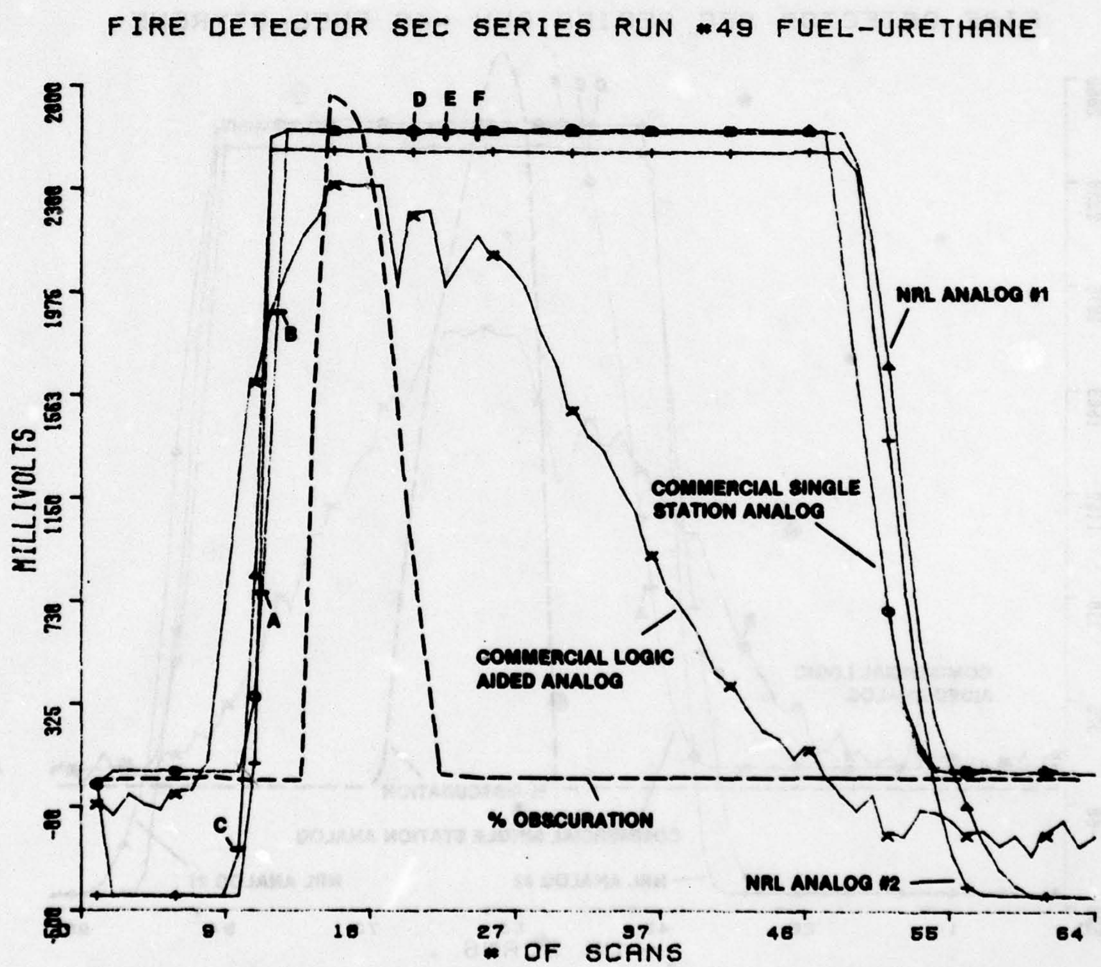


A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW
NO ALARM TO THIS FUEL

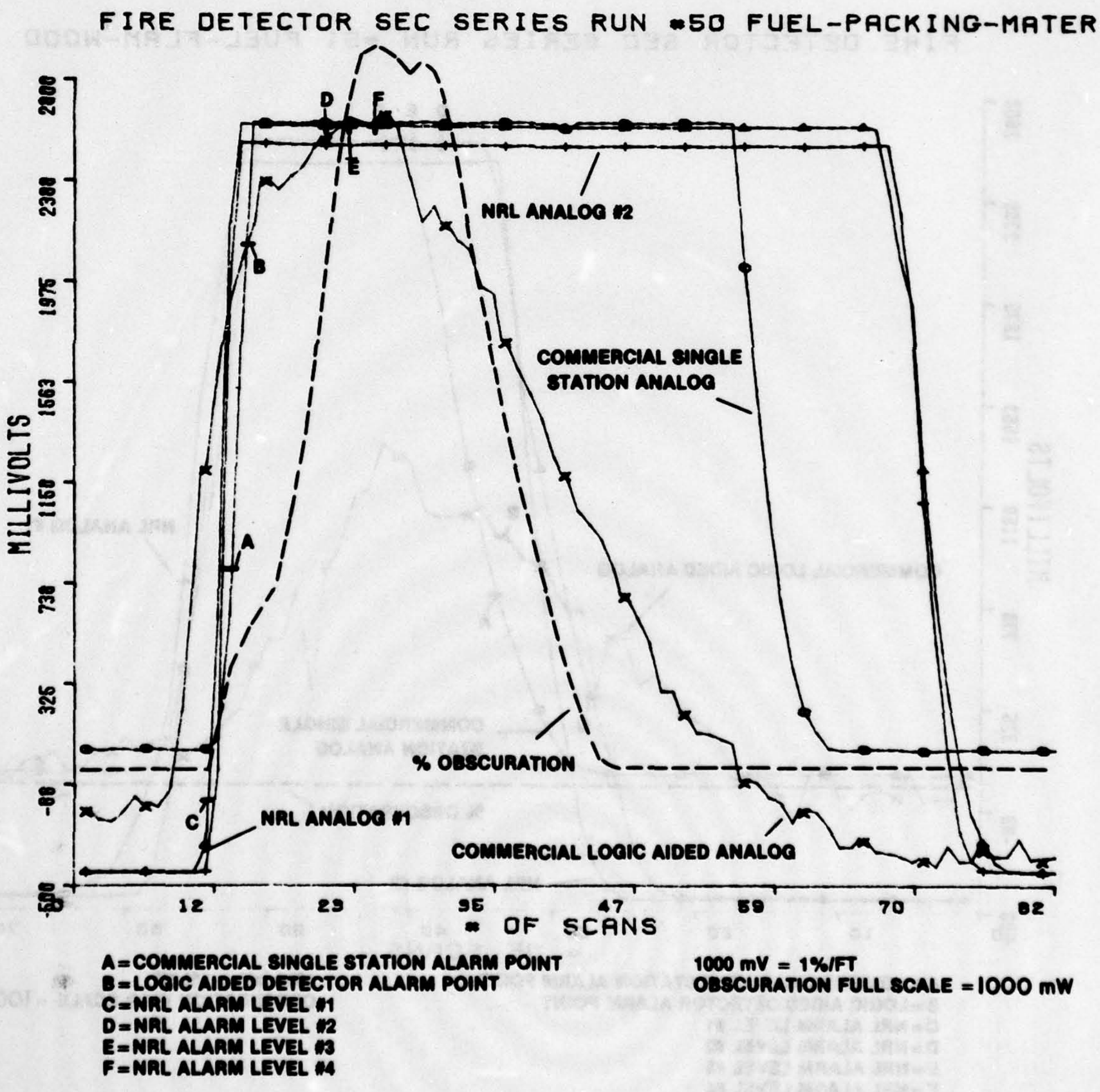

FIRE DETECTOR SEC SERIES RUN #47 FUEL-METHANE
MILLIVOLTS
3000
2563
2126
1688
1250
813
375
-63
-500
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
0
8
15
23
31
39
46
54
# OF SCANS
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 3200 mW
NO ALARM TO THIS FUEL

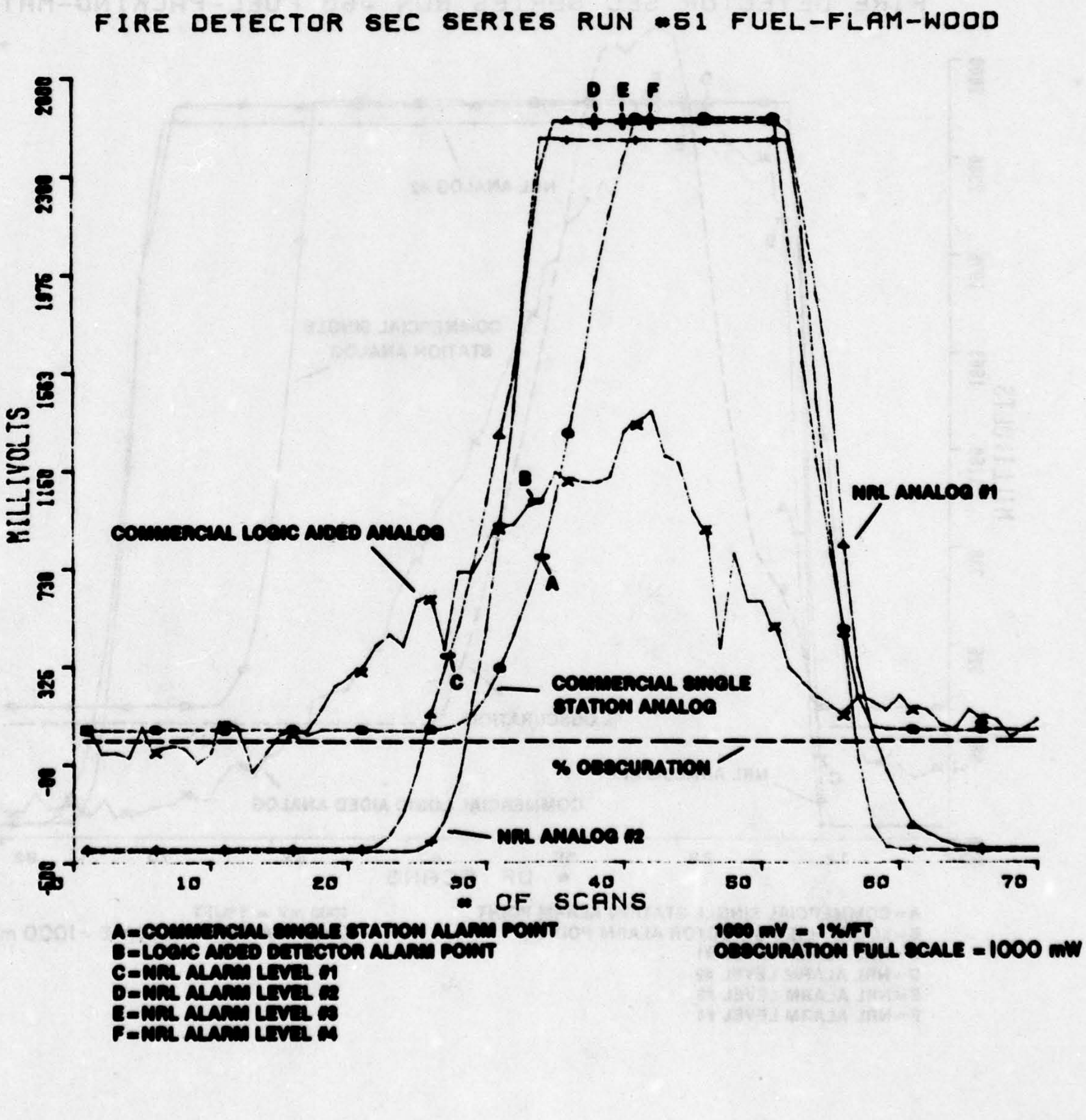

FIRE DETECTOR SEC SERIES RUN #48 FUEL-STYRENE
MILLIVOLTS
2800
2388
1976
1563
1150
738
325
-88
-500
0
14
28
42
56
70
84
98
OF SCANS
D E F
A
B
C
COMMERCIAL LOGIC AIDED ANALOG
% OBSCURATION
COMMERCIAL SINGLE STATION ANALOG
NRL ANALOG #2
NRL ANALOG #1
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 4000 mW

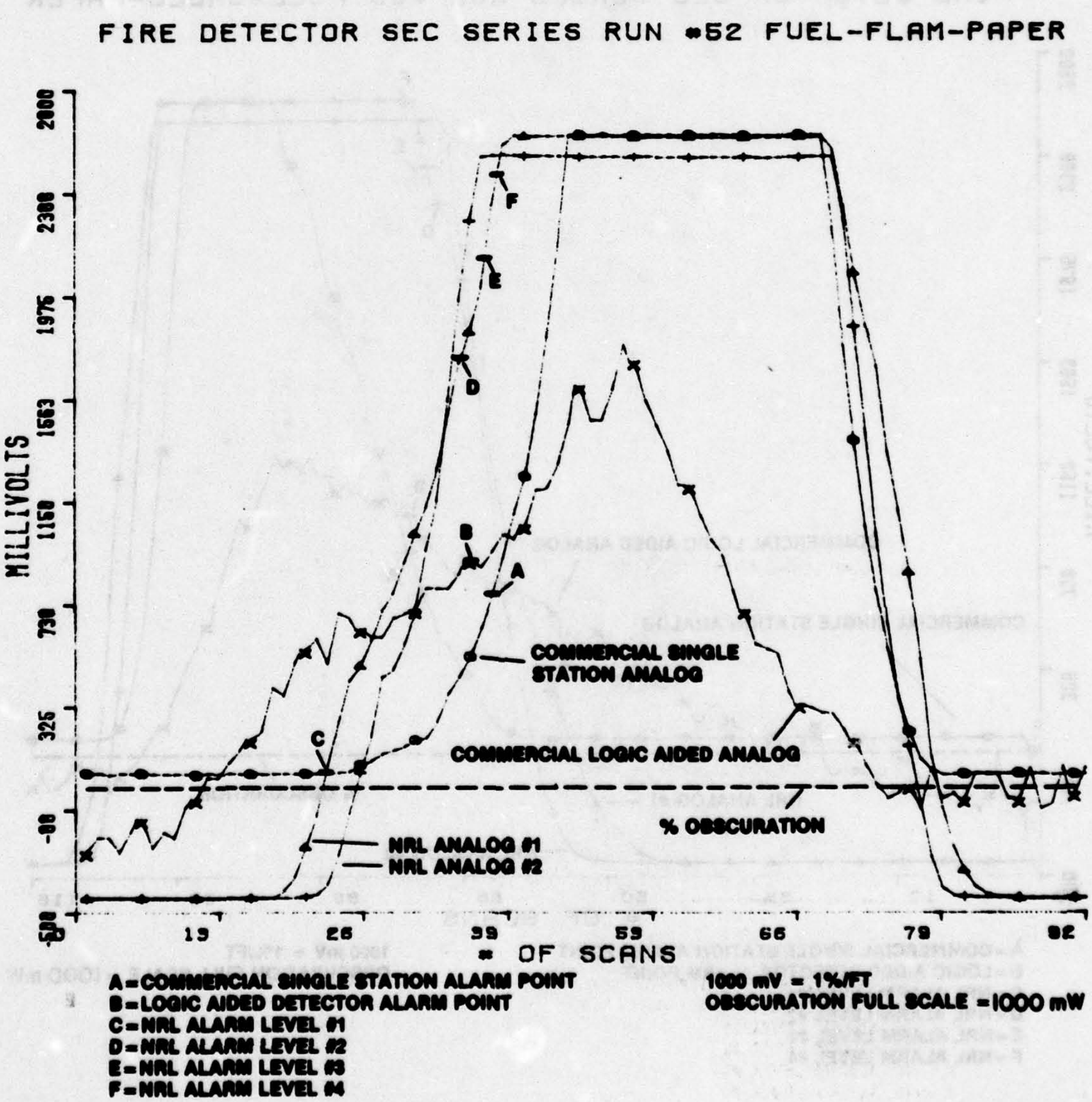


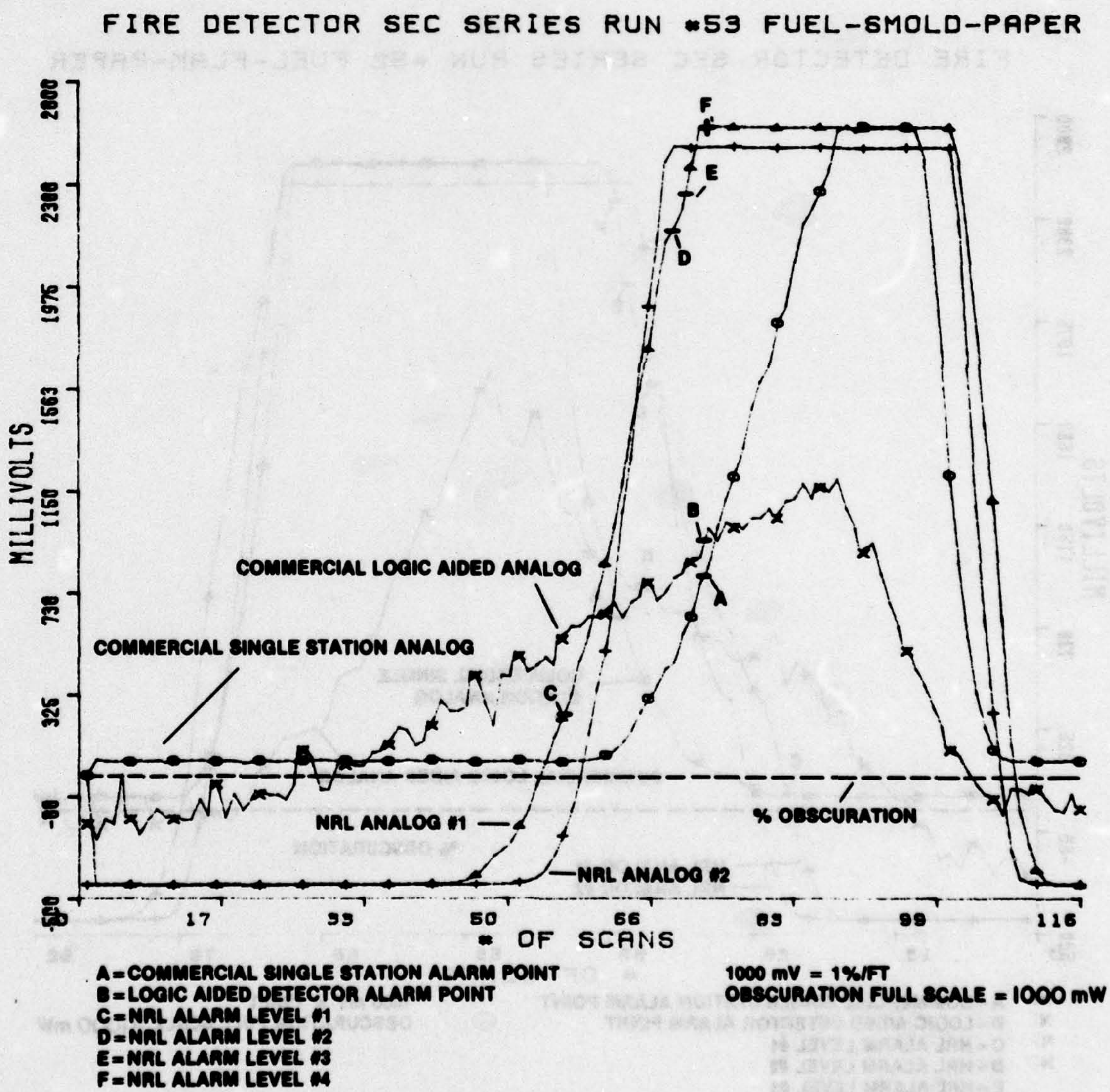
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

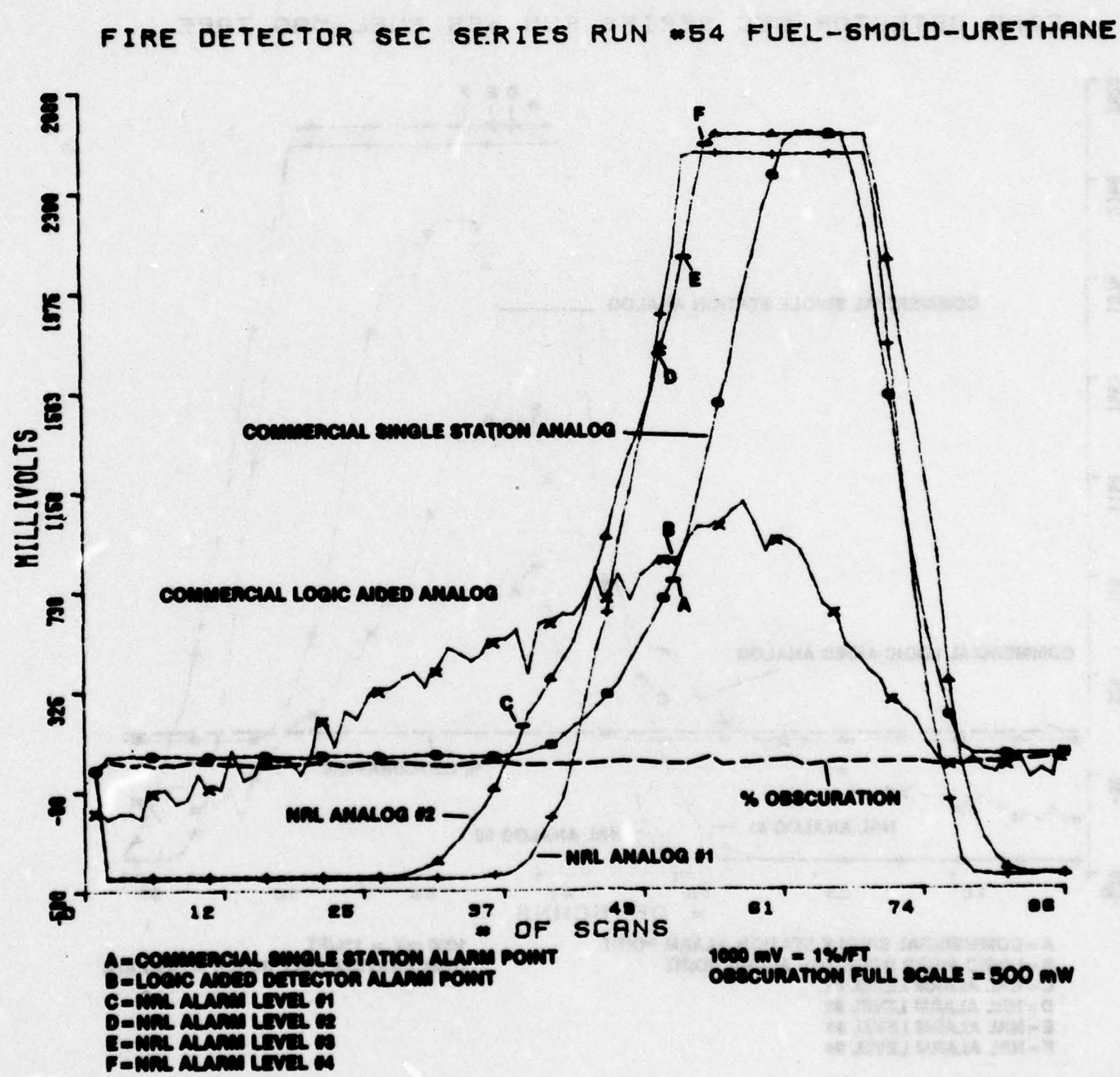
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 600 mW


FIRE DETECTOR SEC SERIES RUN #50 FUEL-PACKING-MATER
MILLIVOLTS
2800
2388
1975
1563
1150
738
325
-88
-500
0
12
23
35
47
59
70
82
OF SCANS
D
F
E
B
A
C
NRL ANALOG #2
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #1
COMMERCIAL LOGIC AIDED ANALOG
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1000 mW

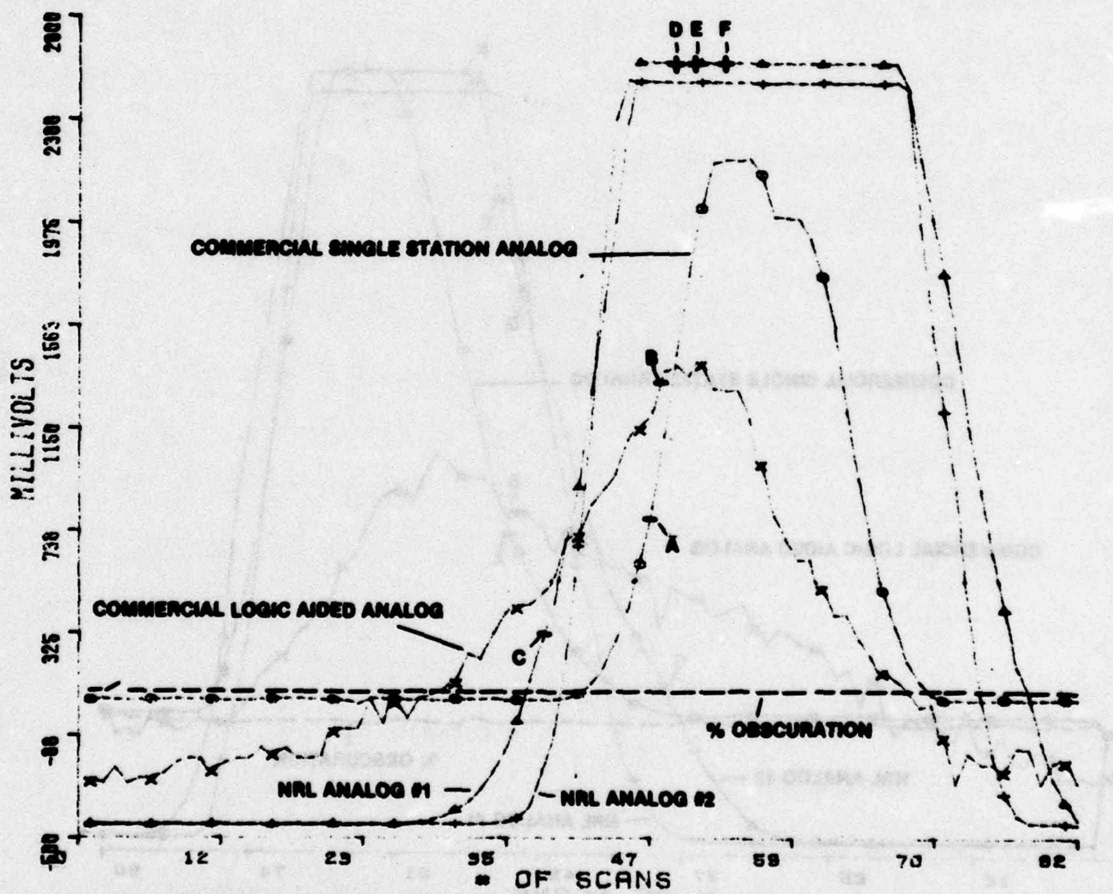

FIRE DETECTOR SEC SERIES RUN #51 FUEL-FLAM-WOOD
MILLIVOLTS
OF SCANS
D E F
A
B
C
NRL ANALOG #1
COMMERCIAL LOGIC AIDED ANALOG
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #2
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1000 mW


FIRE DETECTOR SEC SERIES RUN #52 FUEL-FLAM-PAPER
MILLIVOLTS
2800
2388
1976
1563
1150
738
325
-88
-500
0
13
26
39
53
66
79
92
OF SCANS
F
E
D
B
A
C
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE =1000 mW


FIRE DETECTOR SEC SERIES RUN #53 FUEL-SMOLD-PAPER
MILLIVOLTS
2800
2388
1976
1563
1150
738
325
-88
-500
0
17
33
50
66
83
99
116
OF SCANS
F
E
D
B
A
C
COMMERCIAL LOGIC AIDED ANALOG
COMMERCIAL SINGLE STATION ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1000 mW


FIRE DETECTOR SEC SERIES RUN #54 FUEL-SMOLD-URETHANE
MILLIVOLTS
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
NRL ANALOG #2
NRL ANALOG #1
% OBSCURATION
A
B
C
D
E
F
12
25
37
49
61
74
86
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

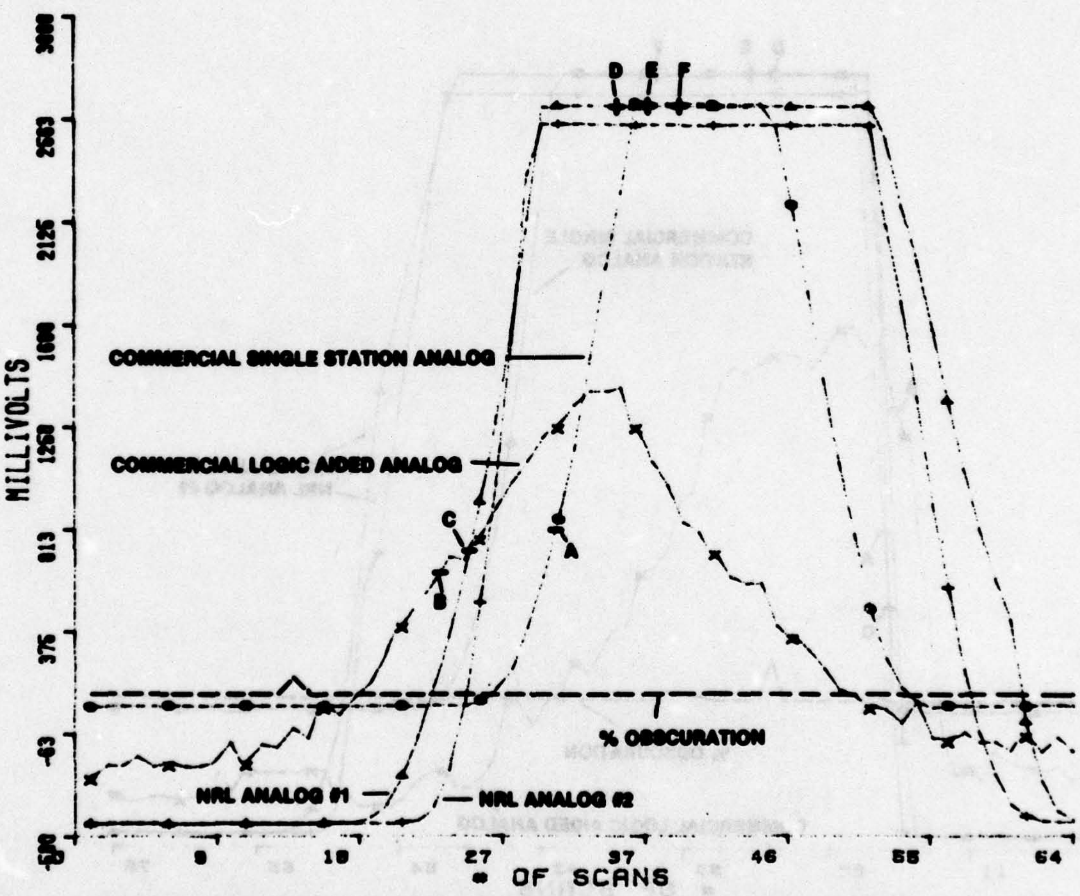
FIRE DETECTOR SEC SERIES RUN #55 FUEL-MAG TAPE



A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

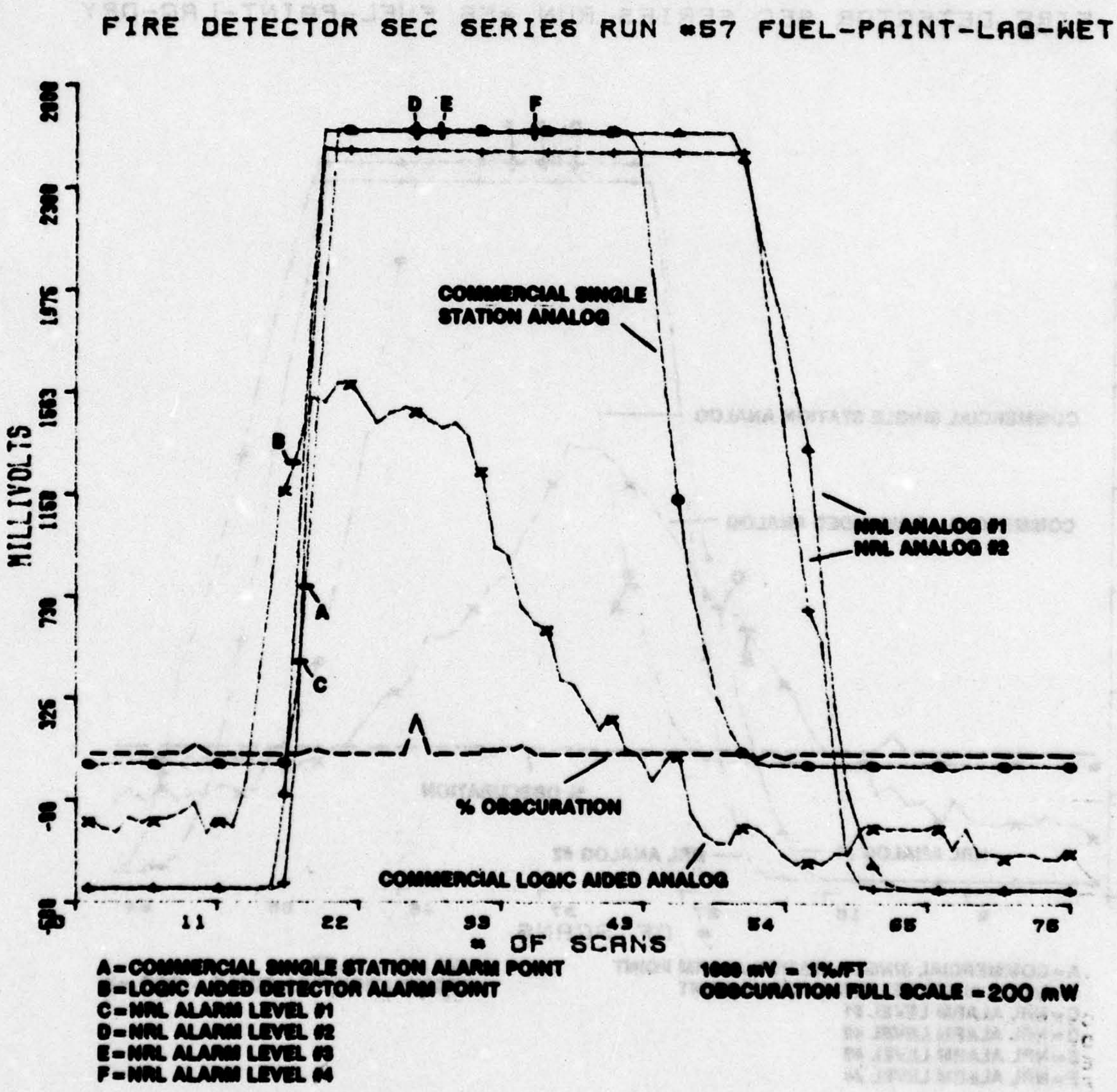
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW

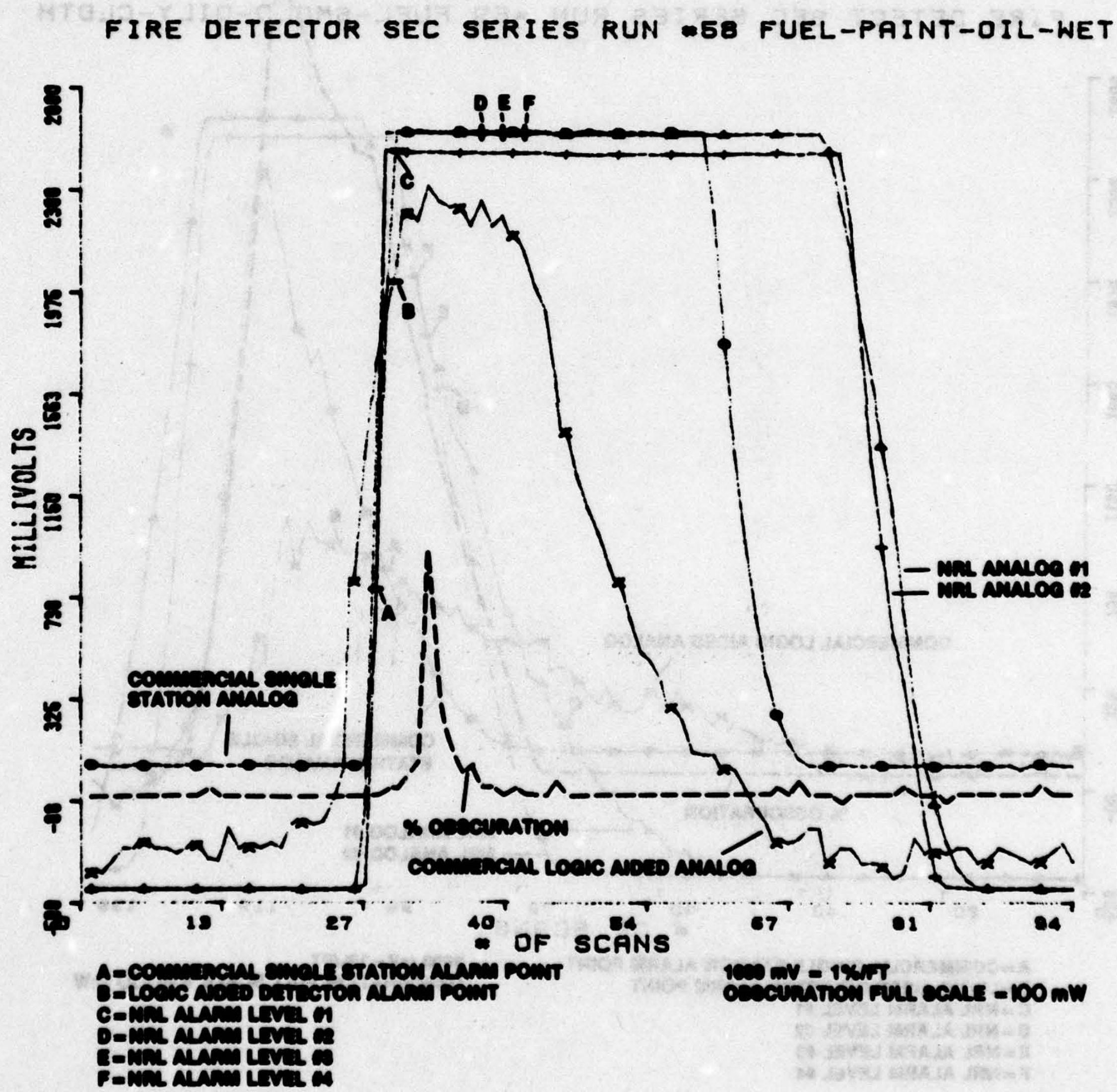
FIRE DETECTOR SEC SERIES RUN #56 FUEL-PAINT-LAQ-DRY

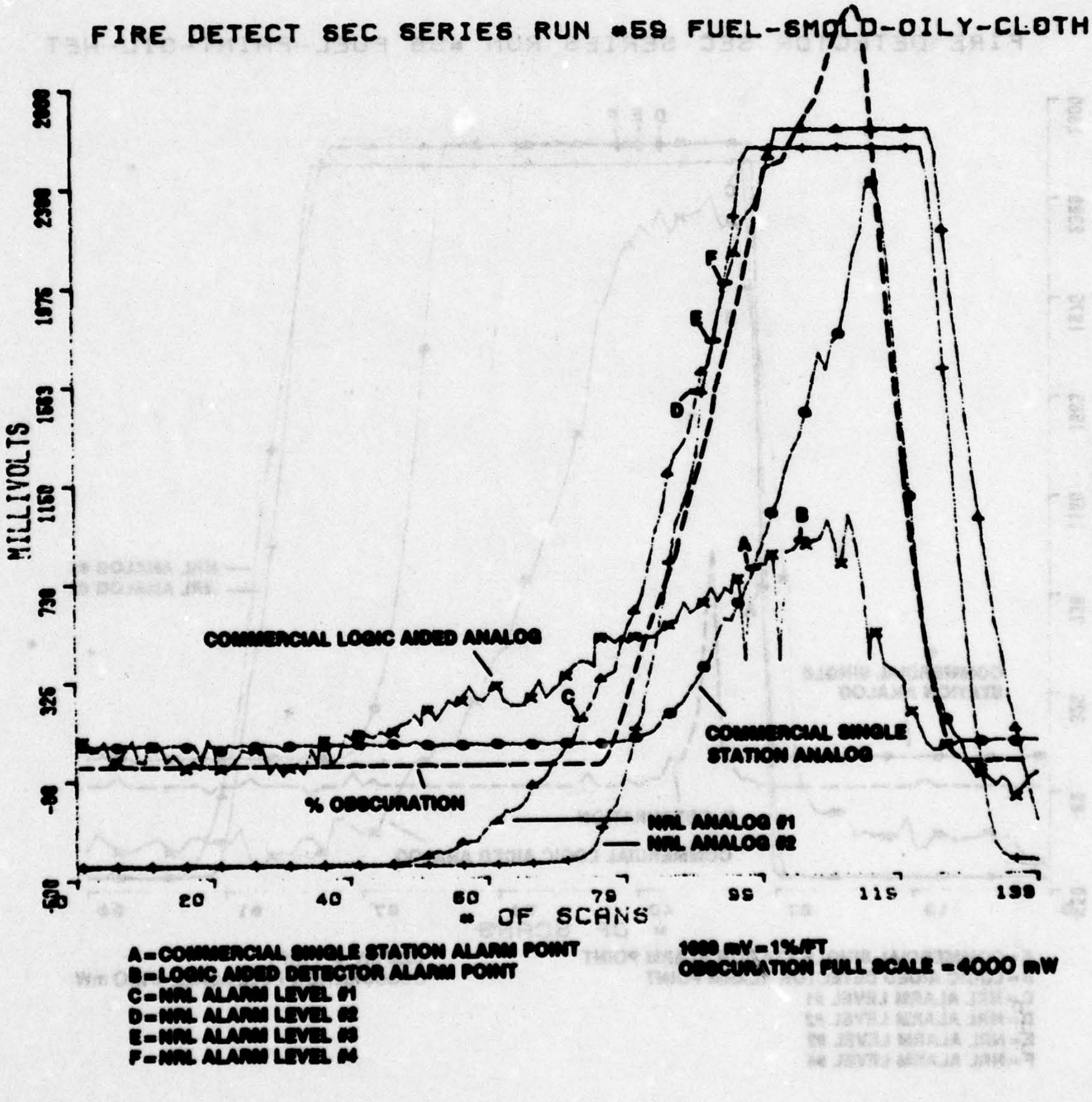


A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

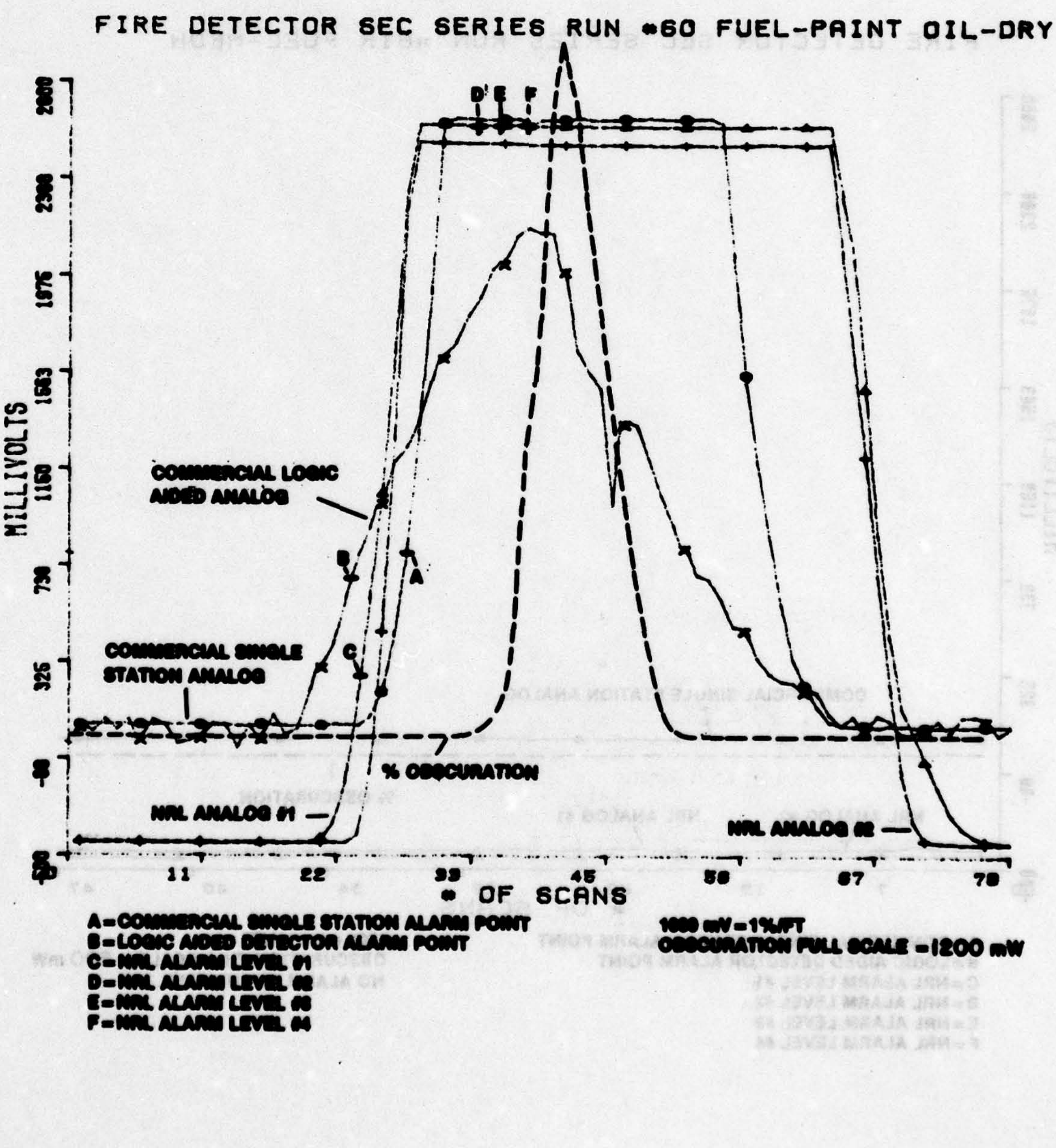
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mV


FIRE DETECTOR SEC SERIES RUN #57 FUEL-PAINT-LAQ-WET
MILLIVOLTS
COMMERCIAL SINGLE STATION ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
COMMERCIAL LOGIC AIDED ANALOG
# OF SCANS
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 200 mW

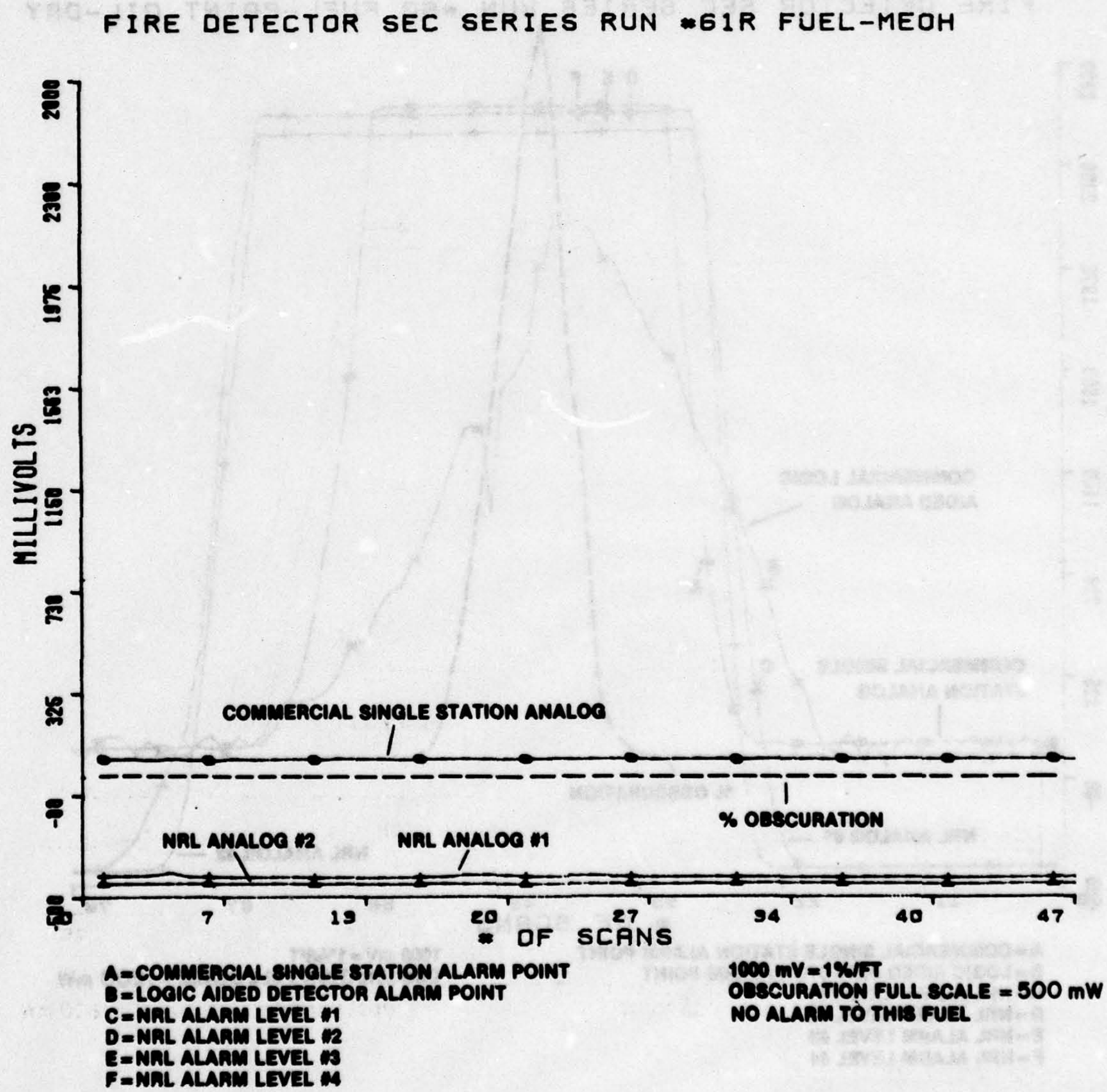

FIRE DETECTOR SEC SERIES RUN #58 FUEL-PAINT-OIL-WET
D E F
C
B
A
MILLIVOLTS
NRL ANALOG #1
NRL ANALOG #2
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
COMMERCIAL LOGIC AIDED ANALOG
OF SCANS
13
27
40
54
67
81
94
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 100 mW

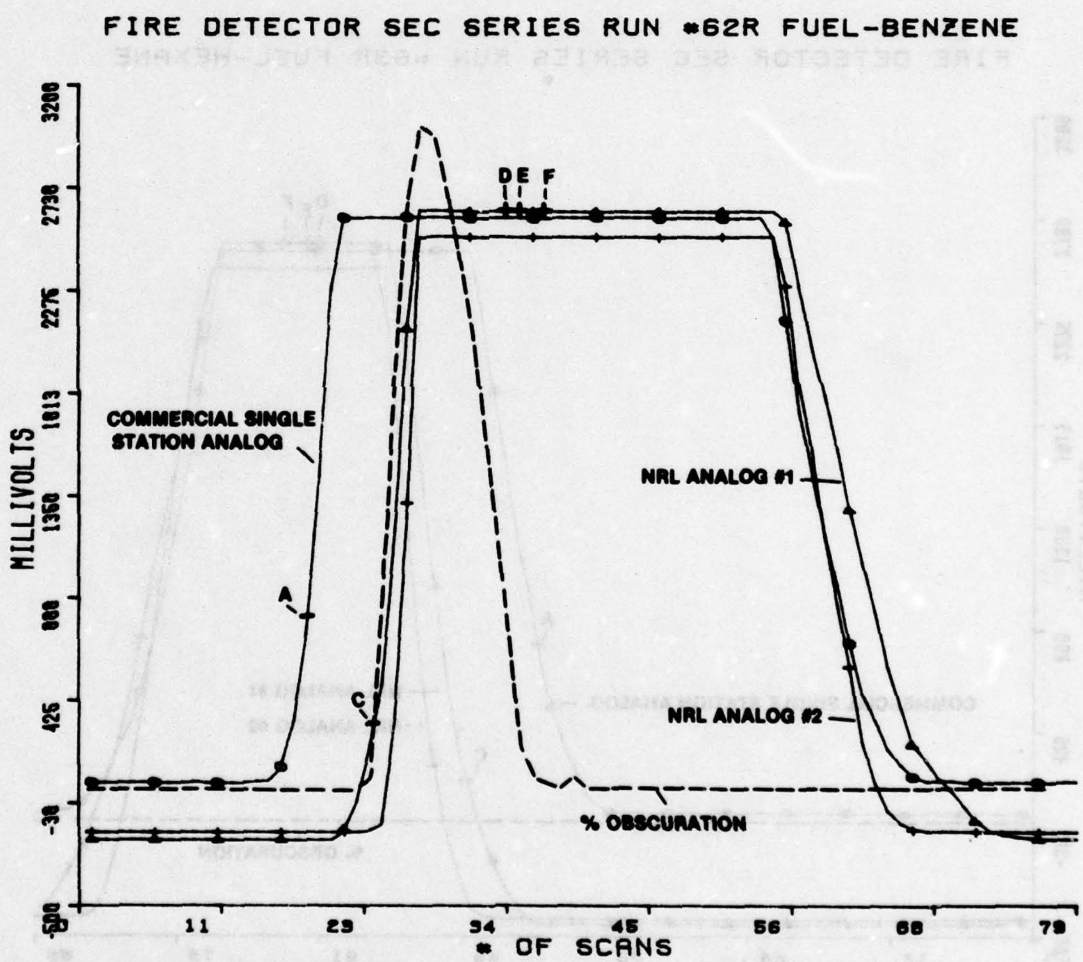


FIRE DETECT SEC SERIES RUN #59 FUEL-SMOLD-OILY-CLOTH
MILLIVOLTS
OF SCANS
COMMERCIAL LOGIC AIDED ANALOG
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
A
B
C
D
E
F
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 4000 mW



FIRE DETECTOR SEC SERIES RUN #60 FUEL-PAINT OIL-DRY
MILLIVOLTS
D E F
COMMERCIAL LOGIC AIDED ANALOG
B
A
C
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
11
22
33
45
56
67
78
# OF SCANS
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1200 mW

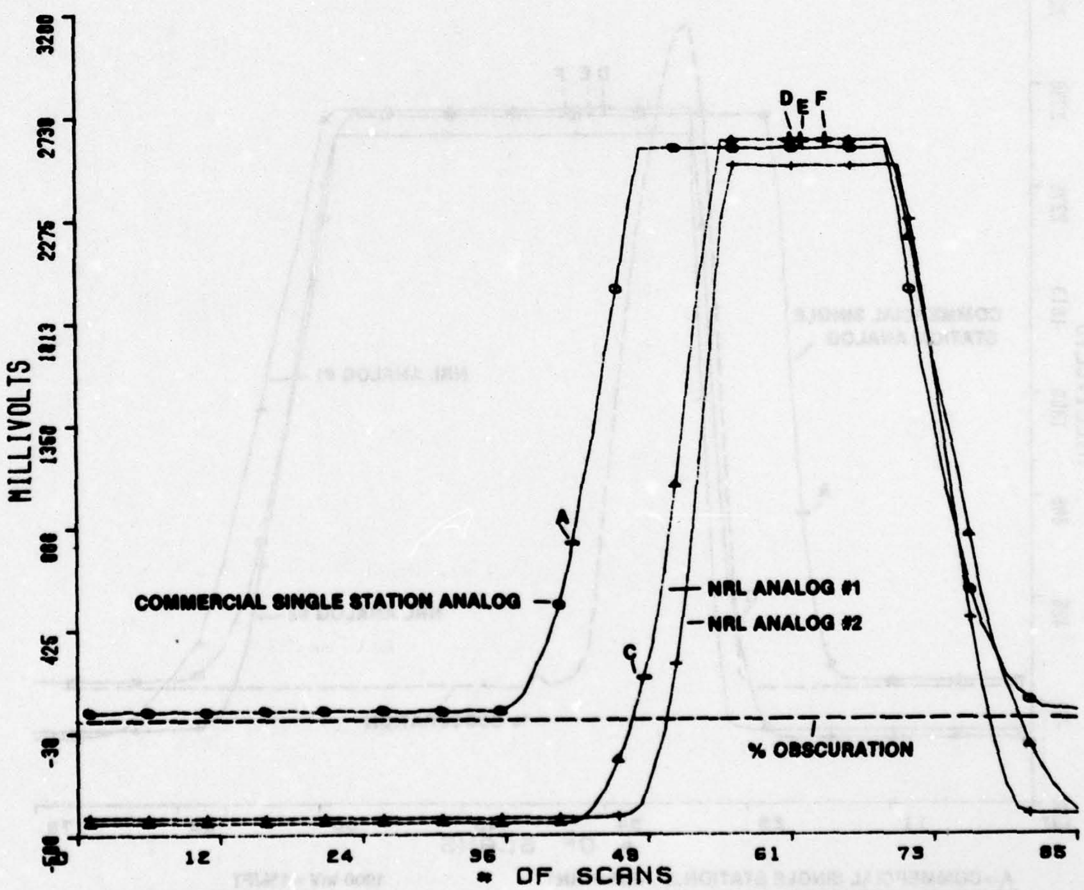

FIRE DETECTOR SEC SERIES RUN *61R FUEL-MEOH
MILLIVOLTS
2800
2388
1976
1563
1150
738
325
-88
-500
0
7
13
20
27
34
40
47
* OF SCANS
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #2
NRL ANALOG #1
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 500 mW
NO ALARM TO THIS FUEL



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1200 mW

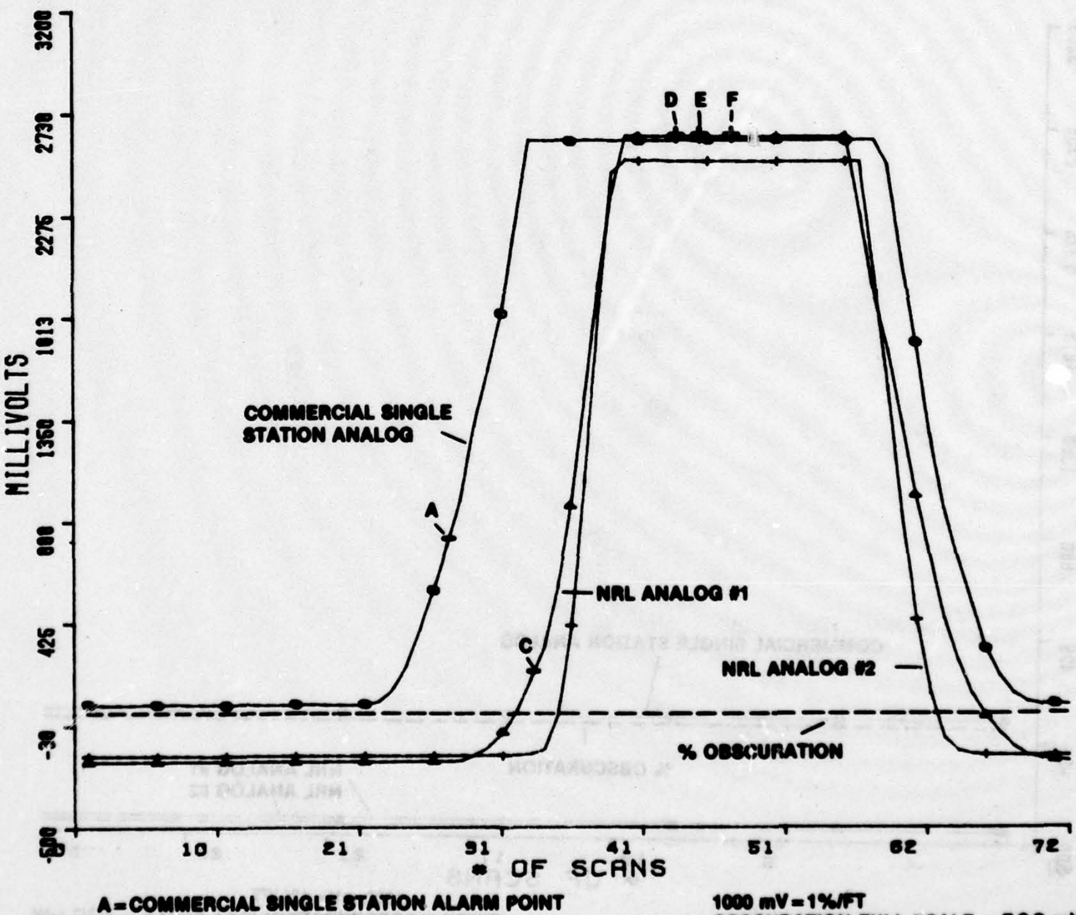
FIRE DETECTOR SEC SERIES RUN #63R FUEL-HEXANE



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

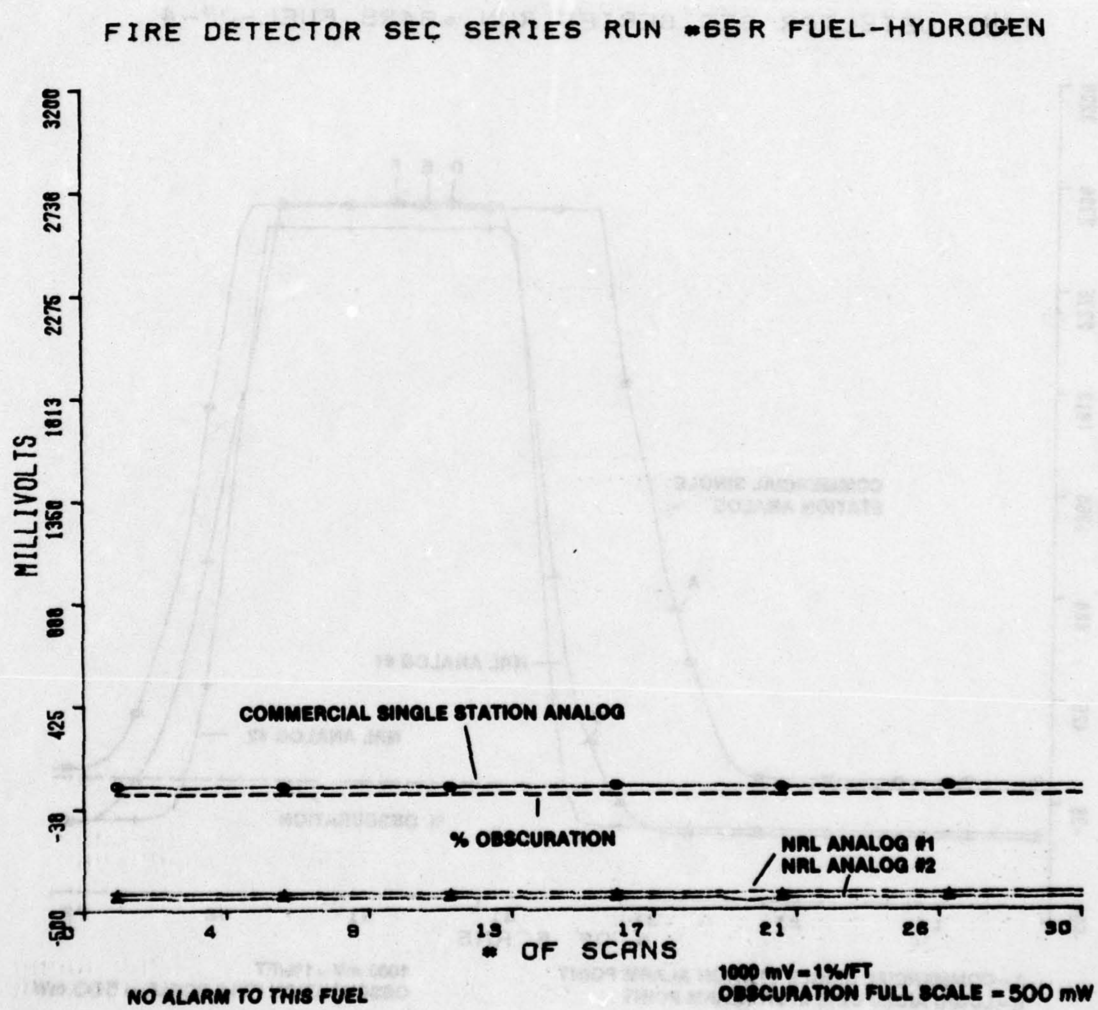
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW

FIRE DETECTOR SEC SERIES RUN #64RB FUEL-JP-4

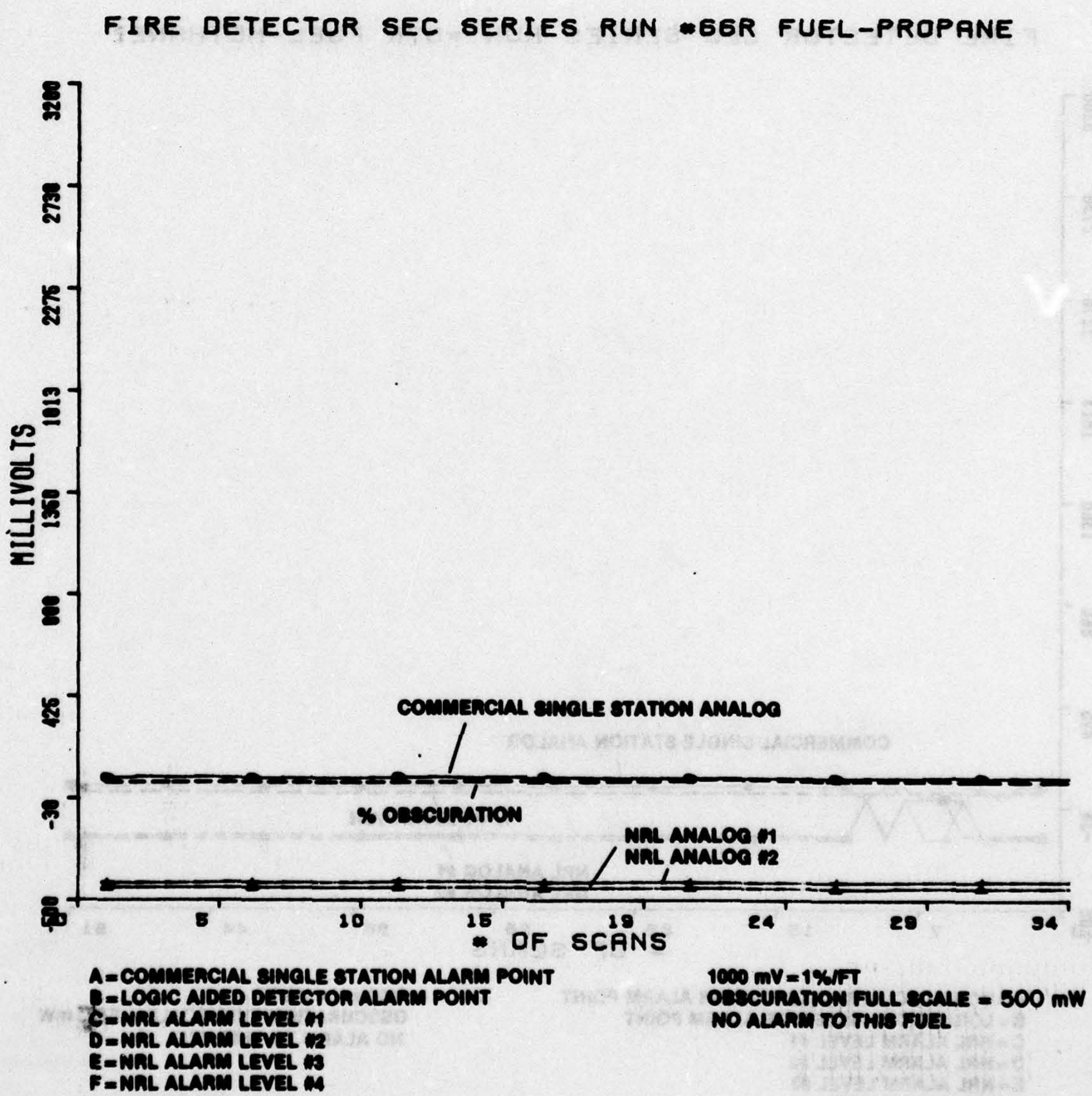


A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

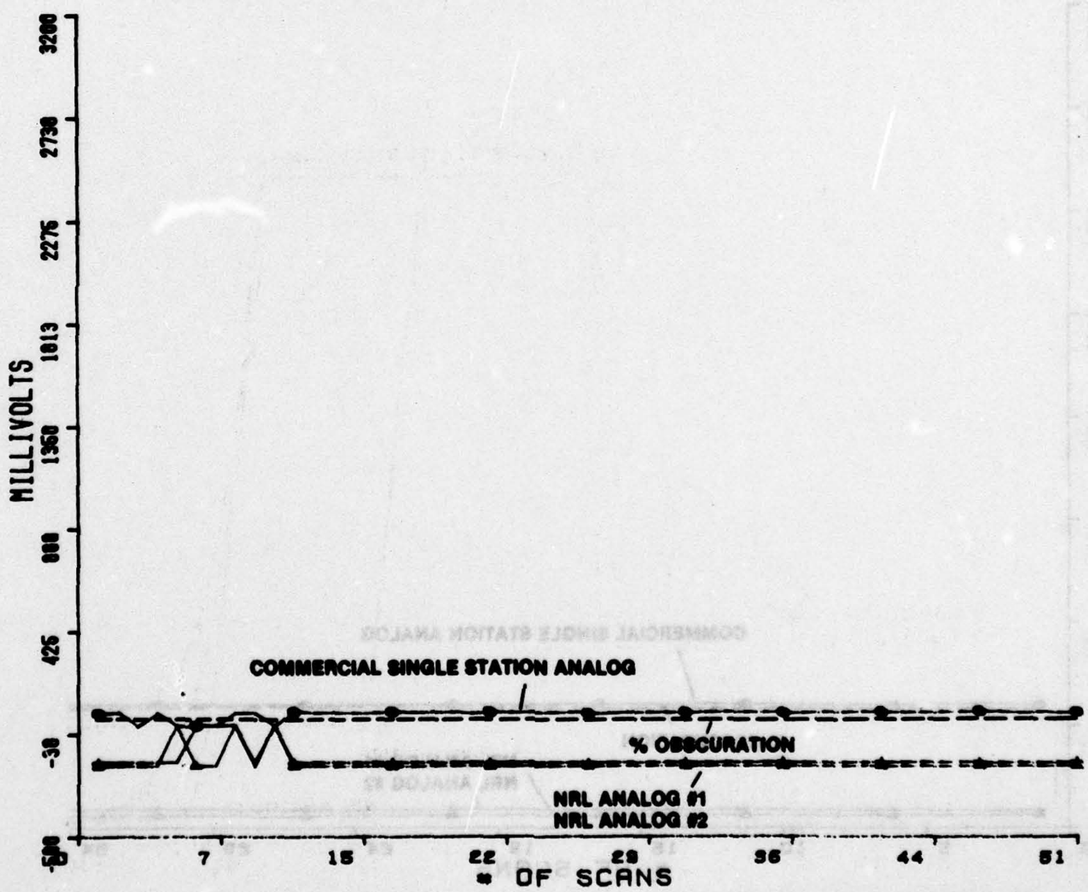
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW



FIRE DETECTOR SEC SERIES RUN #65R FUEL-HYDROGEN
MILLIVOLTS
3200
2738
2276
1813
1350
888
425
-38
-500
0
4
8
13
17
21
26
30
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW
NO ALARM TO THIS FUEL

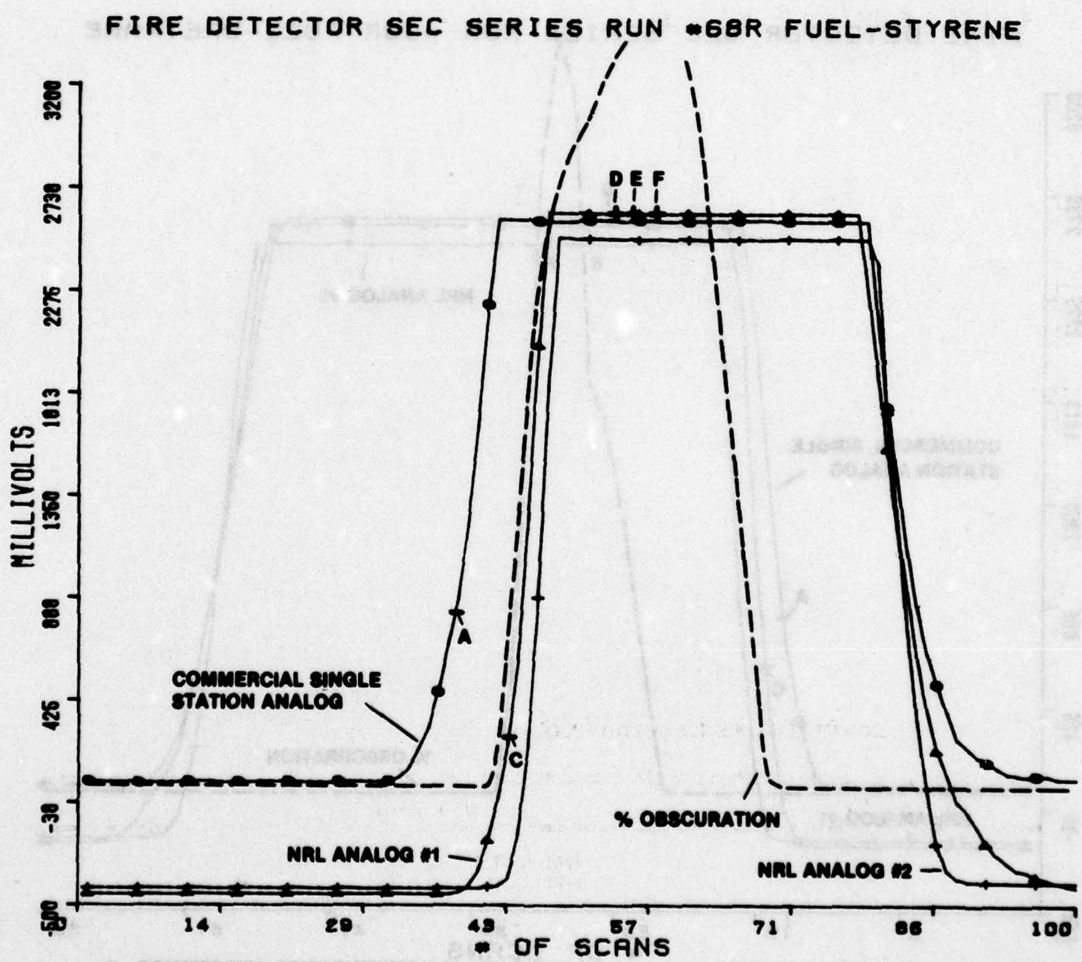

FIRE DETECTOR SEC SERIES RUN #66R FUEL-PROPANE
MILLIVOLTS
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #1
NRL ANALOG #2
# OF SCANS
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW
NO ALARM TO THIS FUEL

FIRE DETECTOR SEC SERIES RUN #67R FUEL-METHANE



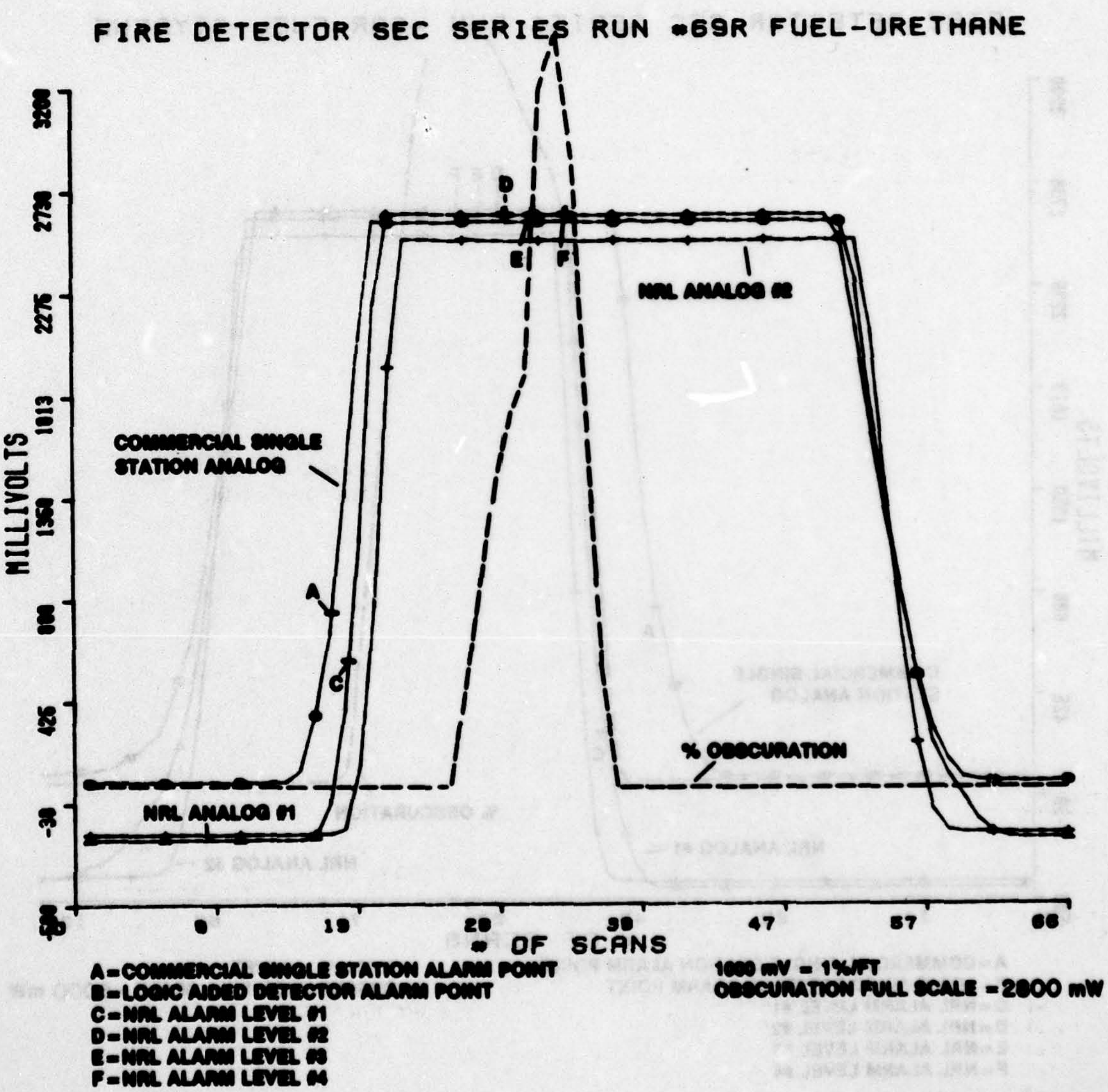
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

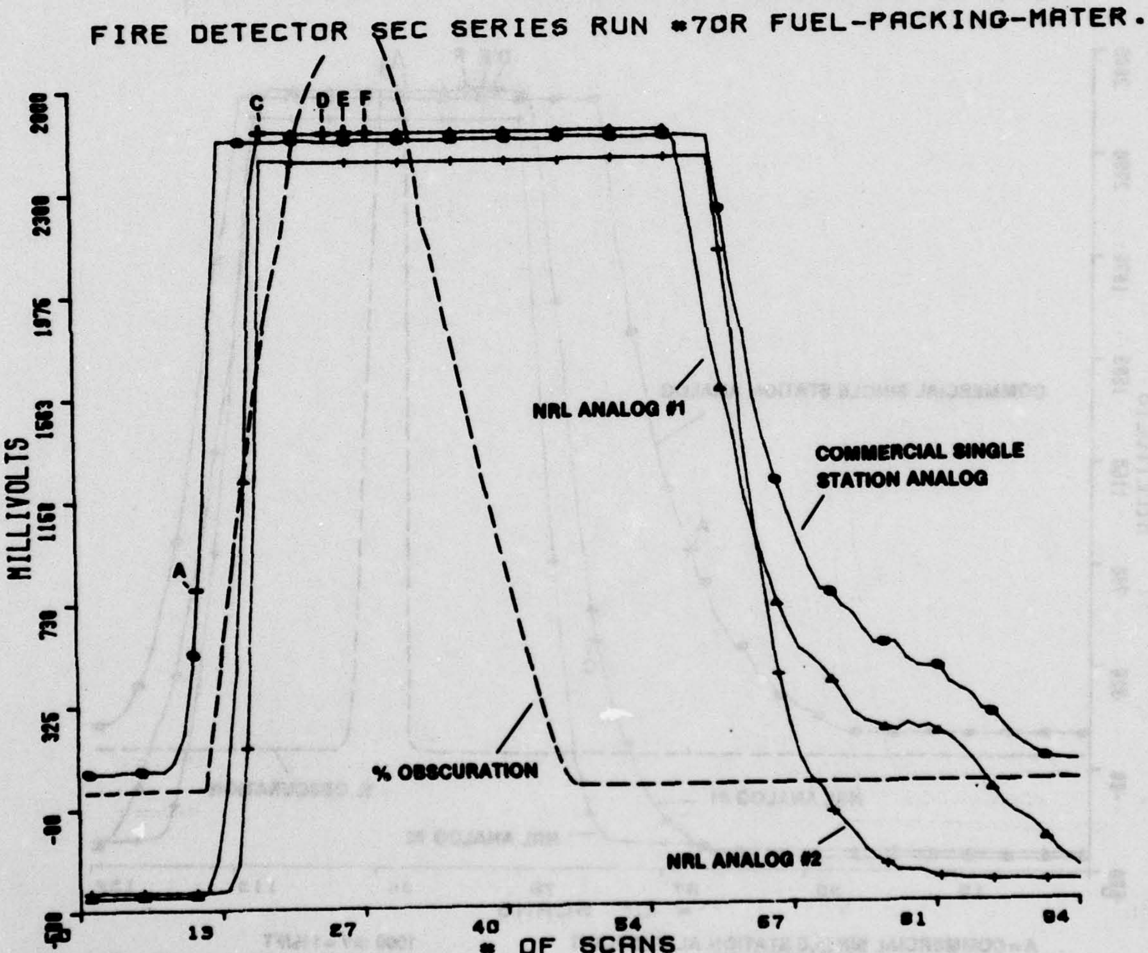
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW
NO ALARM TO THIS FUEL



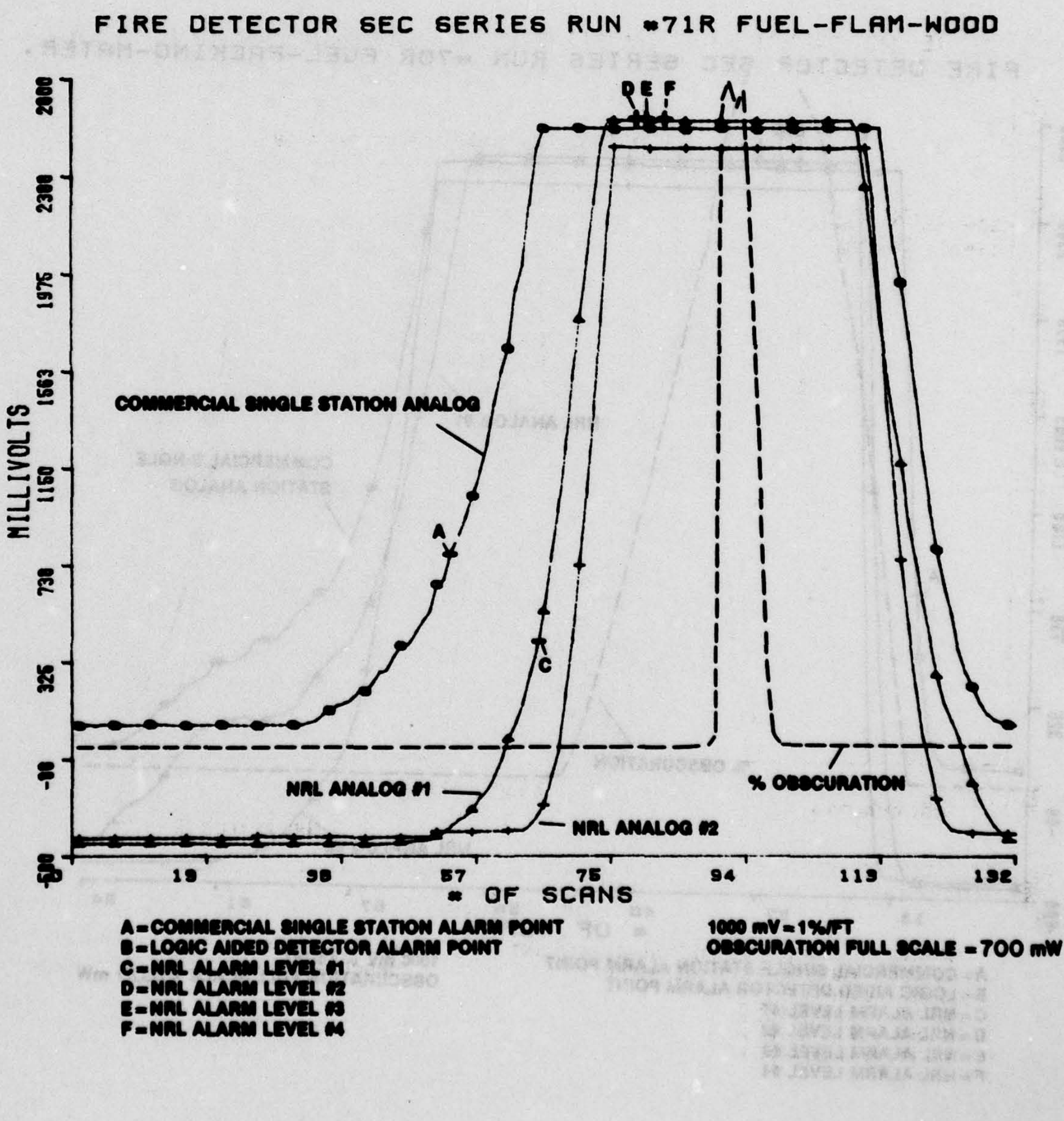
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 6000 mW

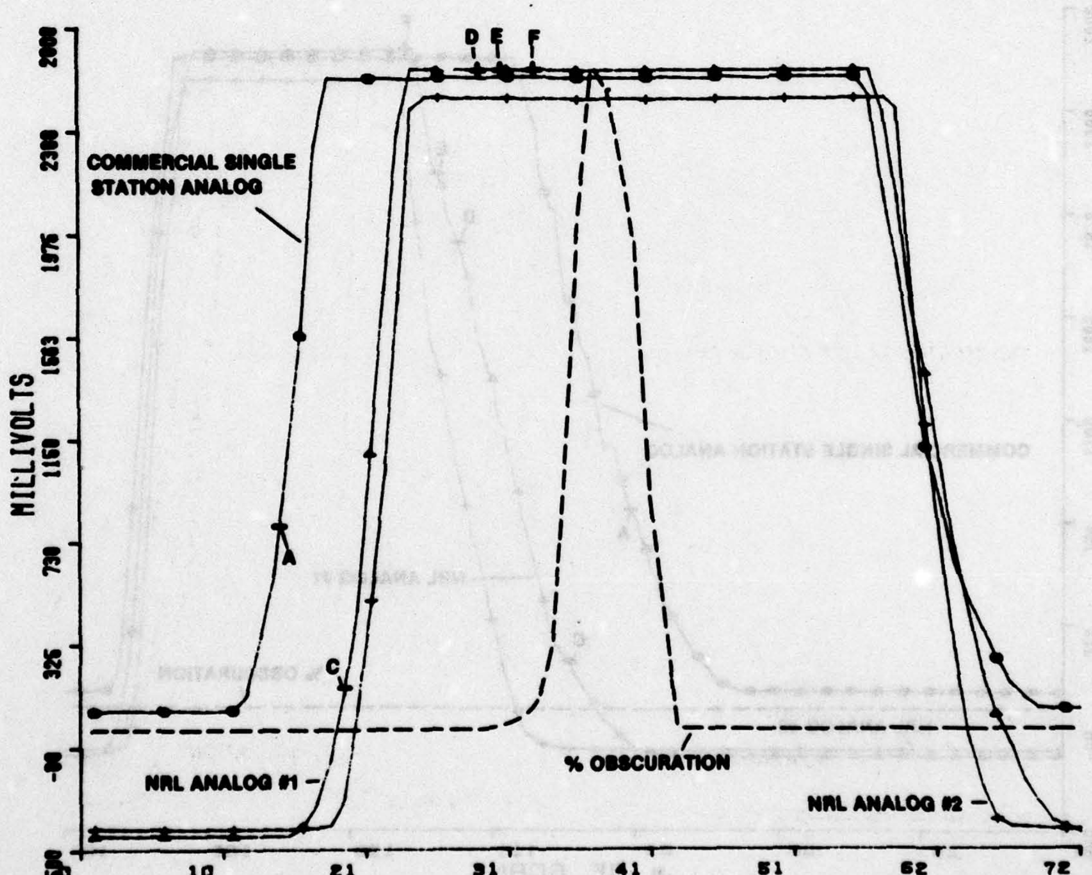

FIRE DETECTOR SEC SERIES RUN #69R FUEL-URETHANE
MILLIVOLTS
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
A
C
D
E
F
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 2800 mW



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4


FIRE DETECTOR SEC SERIES RUN #71R FUEL-FLAM-WOOD
MILLIVOLTS
2800
2388
1975
1563
1150
738
325
-88
-500
0
19
38
57
75
94
113
132
OF SCANS
D E F
COMMERCIAL SINGLE STATION ANALOG
A
C
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 700 mW

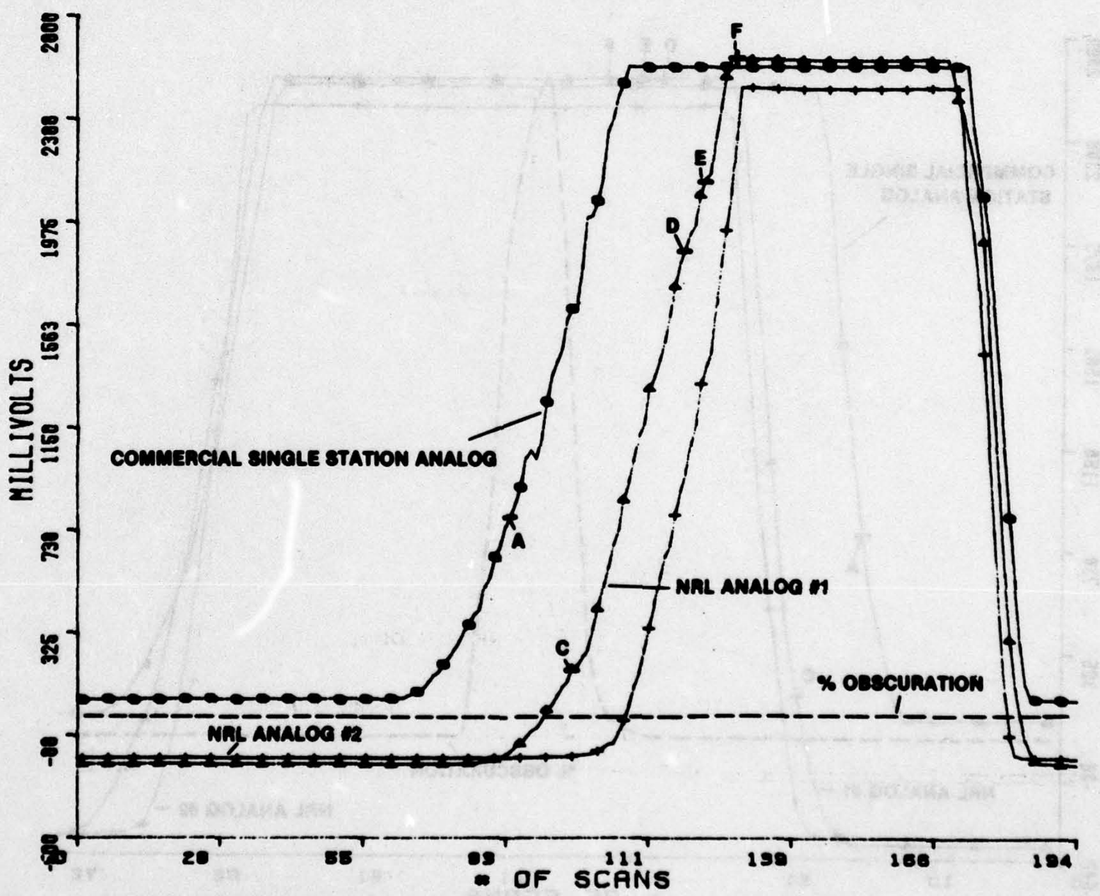
FIRE DETECTOR SEC SERIES RUN #72R FUEL-FLAM-PAPER



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

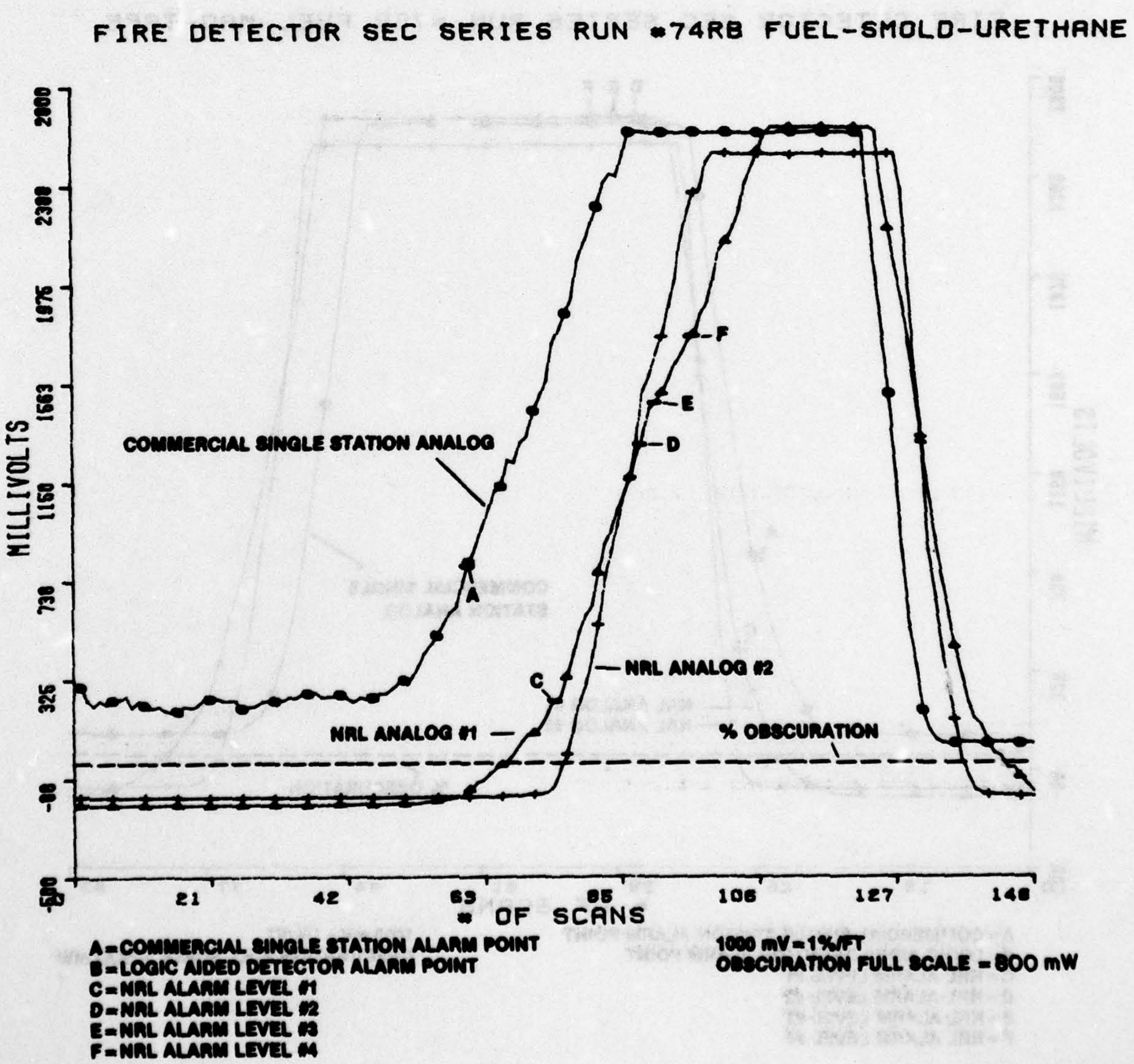
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 2000 mW

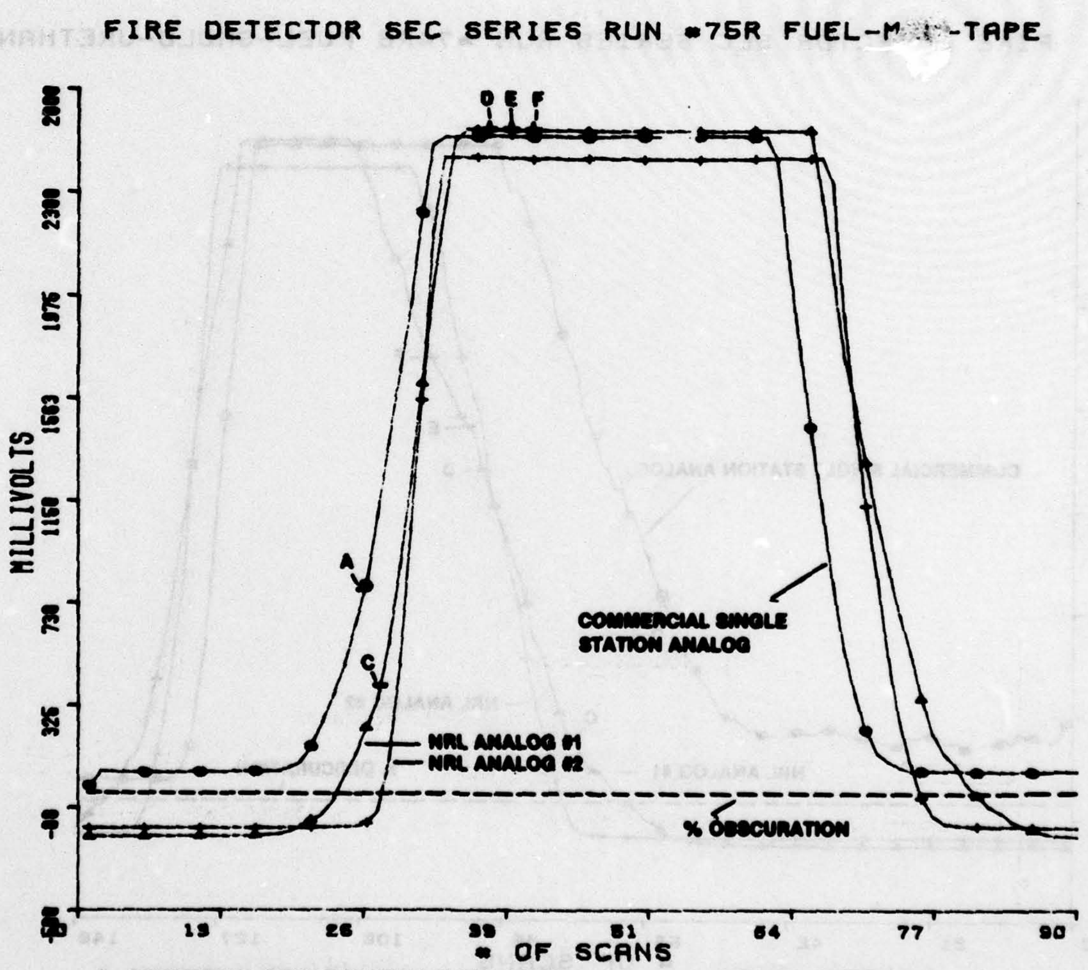
FIRE DETECTOR SEC SERIES RUN #73R FUEL-SMOLD-PAPER



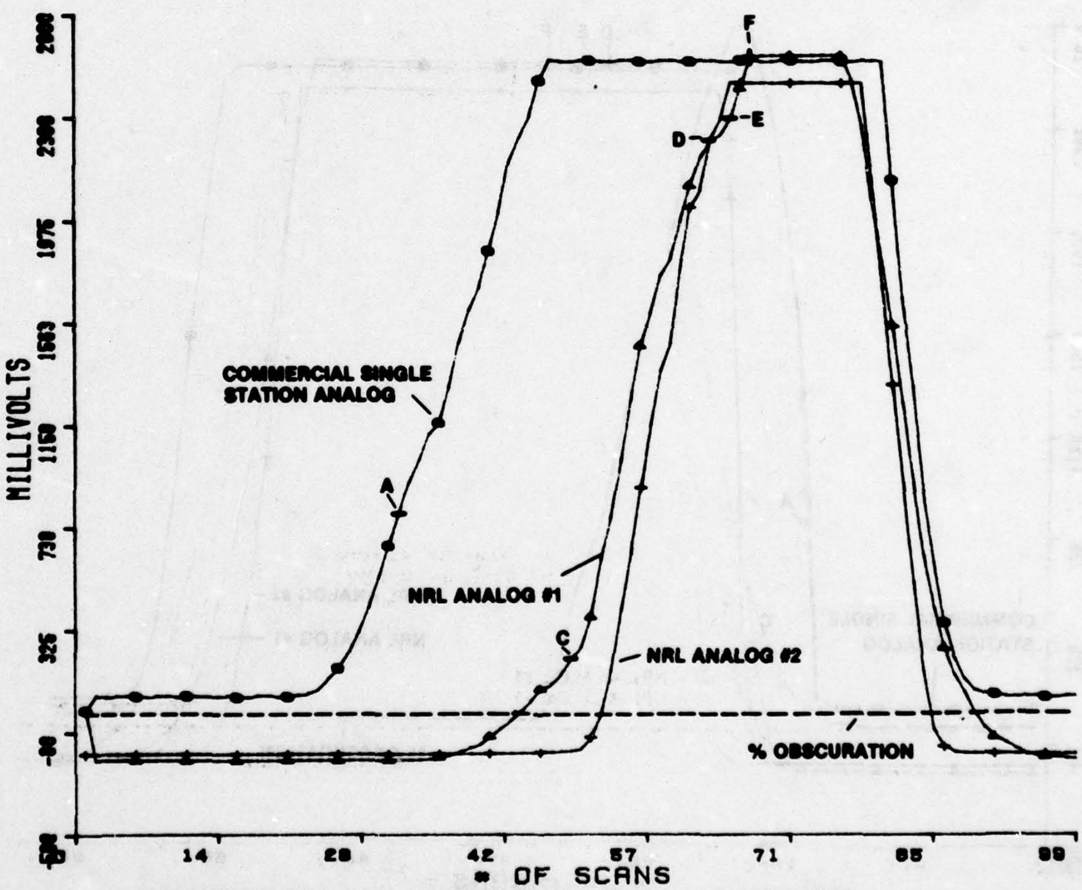
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 5000 mW


FIRE DETECTOR SEC SERIES RUN #74RB FUEL-SMOLD-URETHANE
MILLIVOLTS
2800
2388
1976
1563
1150
738
325
-88
-500
0
21
42
63
85
106
127
148
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
NRL ANALOG #2
NRL ANALOG #1
% OBSCURATION
A
C
D
E
F
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 800 mW

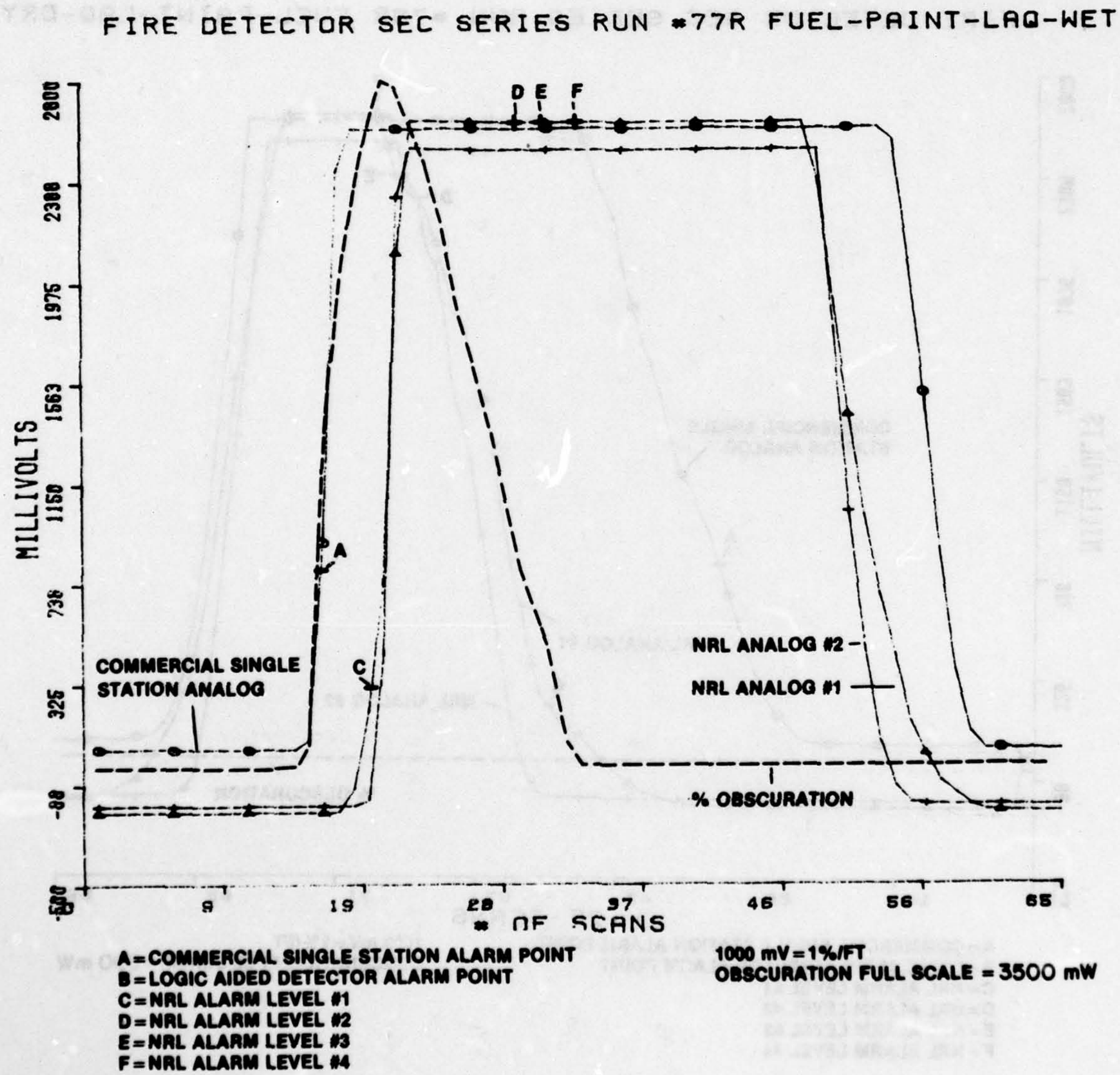

FIRE DETECTOR SEC SERIES RUN #75R FUEL-M -TAPE
D E F
MILLIVOLTS
A
C
COMMERCIAL SINGLE STATION ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
13
26
39
51
64
77
90
# OF SCANS
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE =500 mW

FIRE DETECTOR SEC SERIES RUN #76R FUEL-PAINT-LAQ-DRY



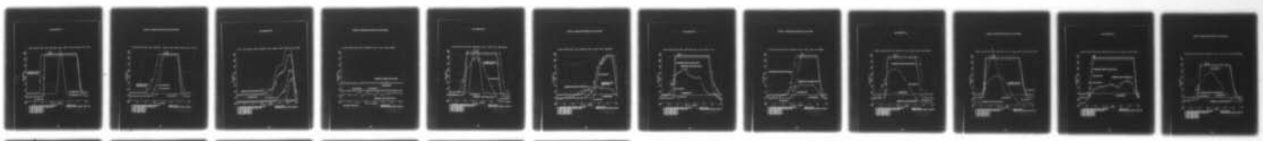
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

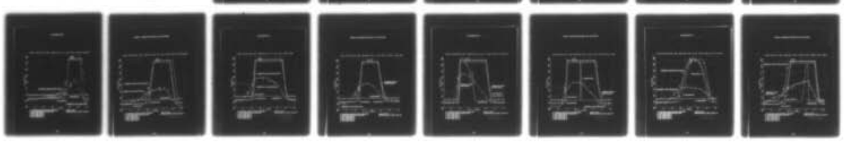
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW


FIRE DETECTOR SEC SERIES RUN *77R FUEL-PAINT-LAQ-WET
MILLIVOLTS
2800
2388
1975
1563
1150
738
325
-88
-500
0
9
19
28
37
46
56
65
* OF SCANS
D E F
A
C
COMMERCIAL SINGLE STATION ANALOG
NRL ANALOG #2
NRL ANALOG #1
% OBSCURATION
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 3500 mW

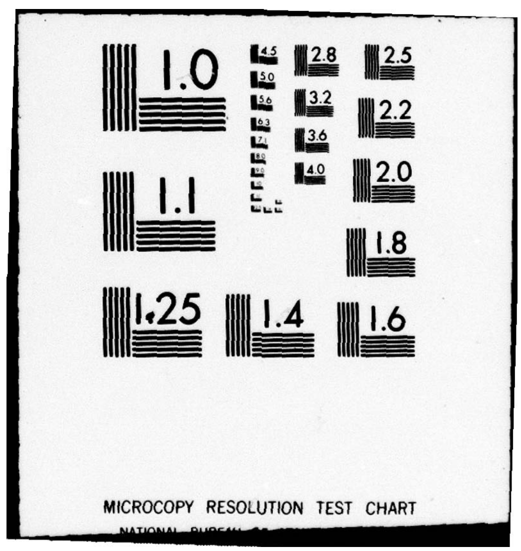
AD-A077 665 NAVAL RESEARCH LAB WASHINGTON DC F/G 13/12
NRL PROCESSOR-AIDED FIRE DETECTION SYSTEM.(U)
SEP 79 T T STREET , K D LAWRENCE
UNCLASSIFIED NRL-8341 NL

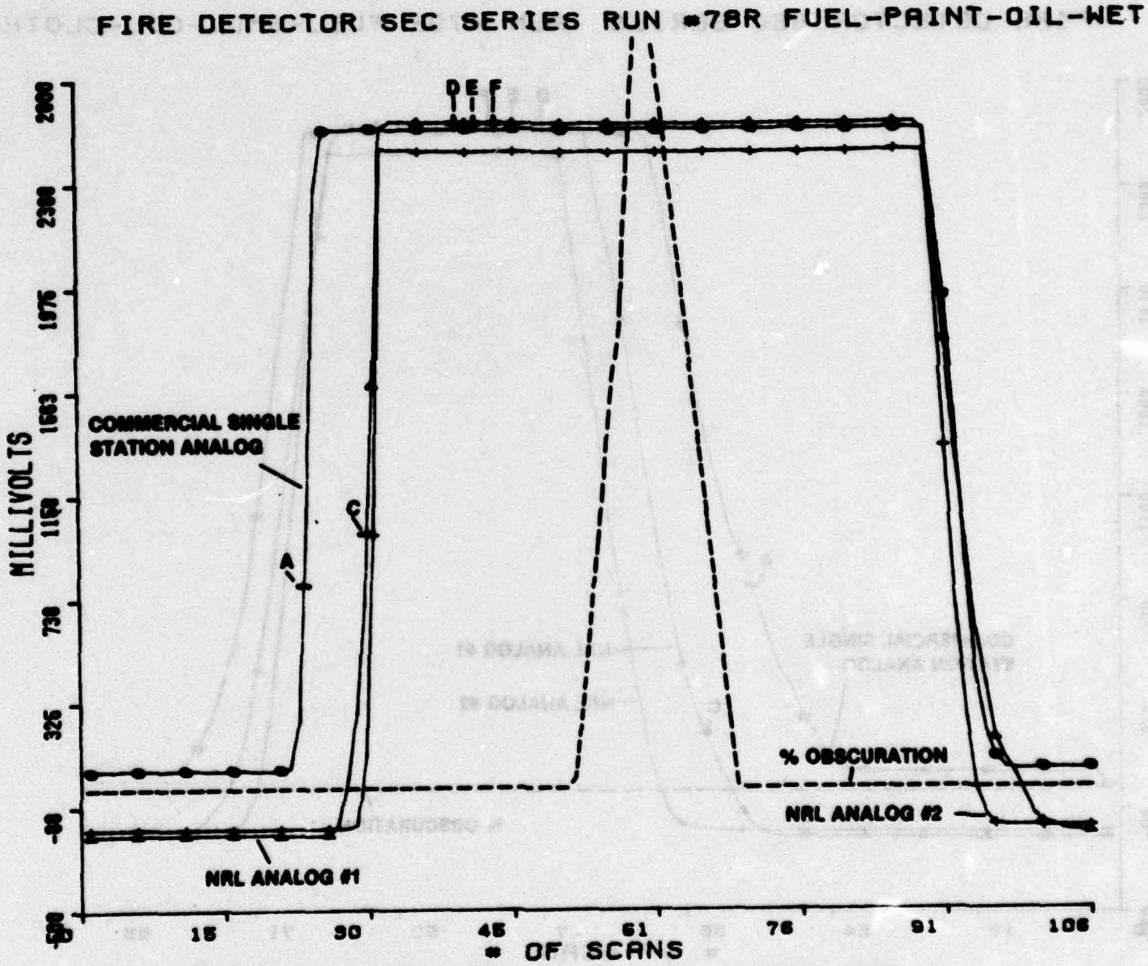
2 OF 2
ADA
077665





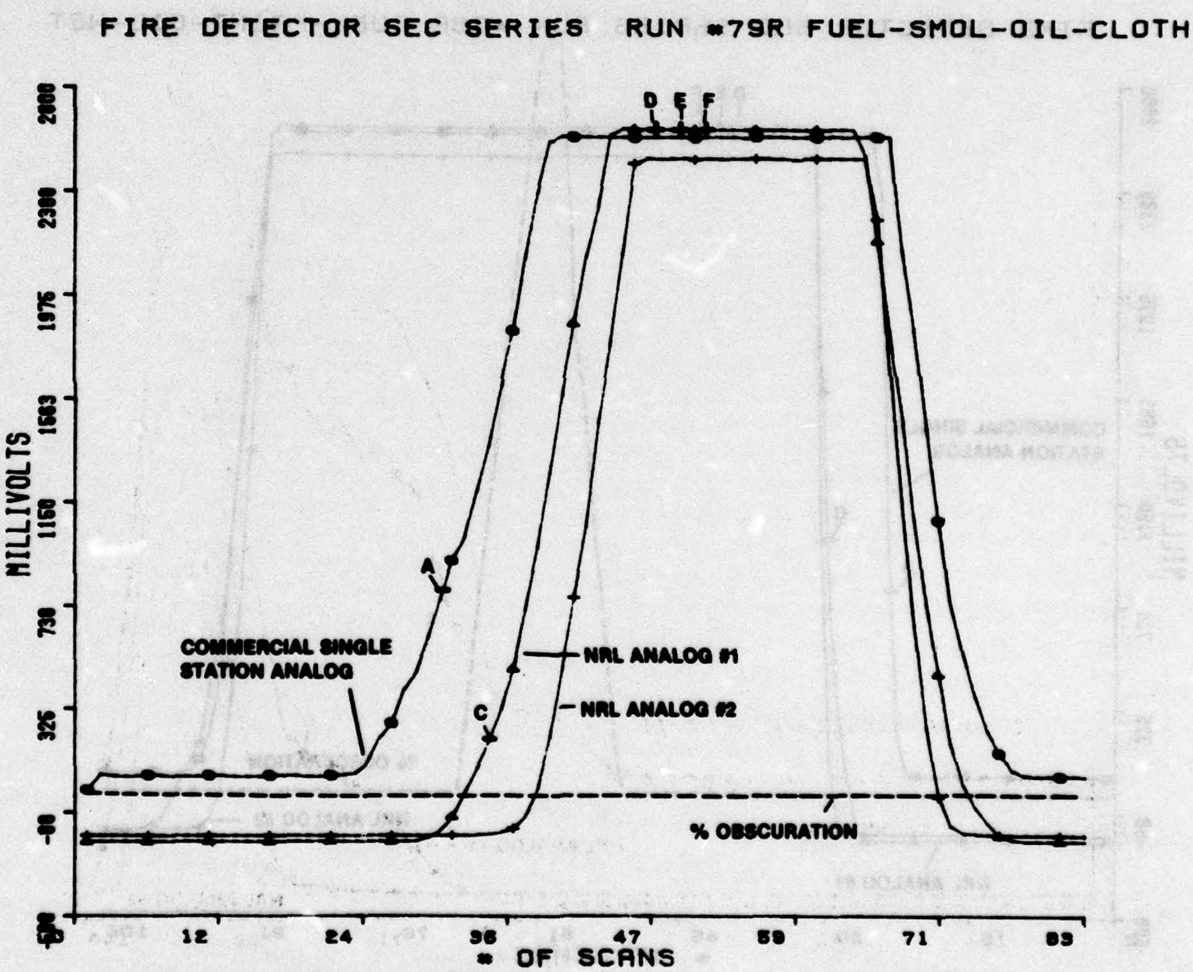
END
DATE
FILMED
1 -80
DDC


1.0
4.5
5.0
5.6
6.3
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART



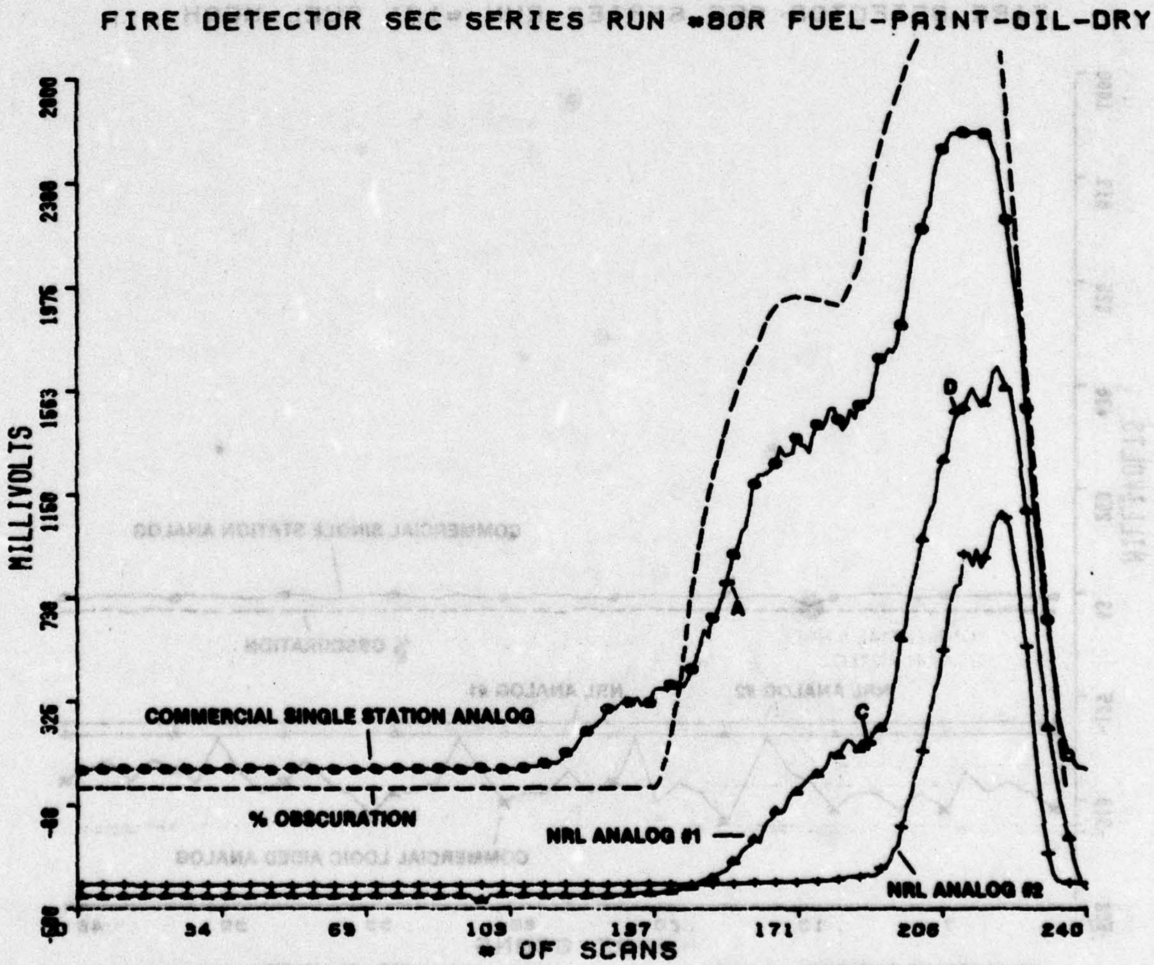
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 7500 mW



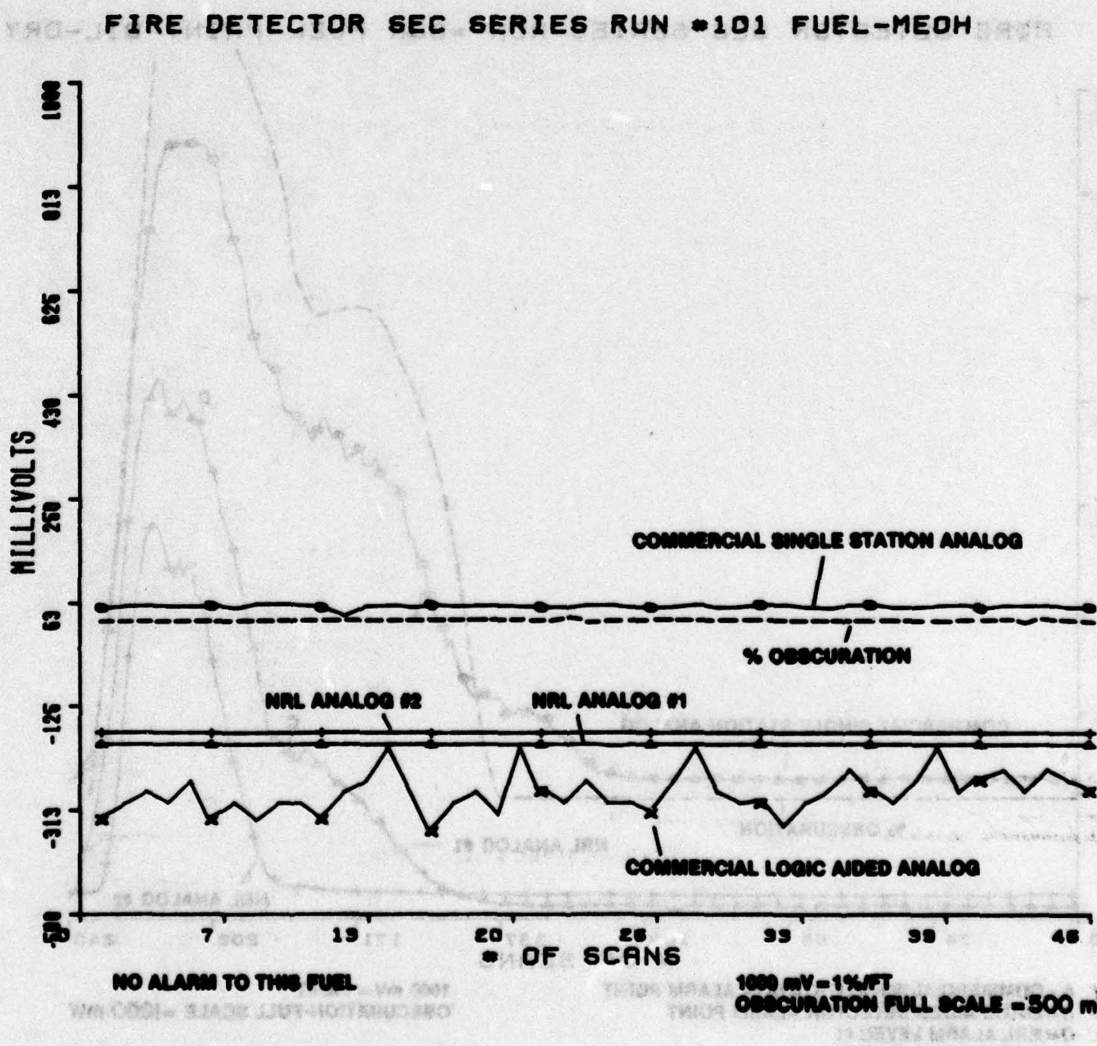
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

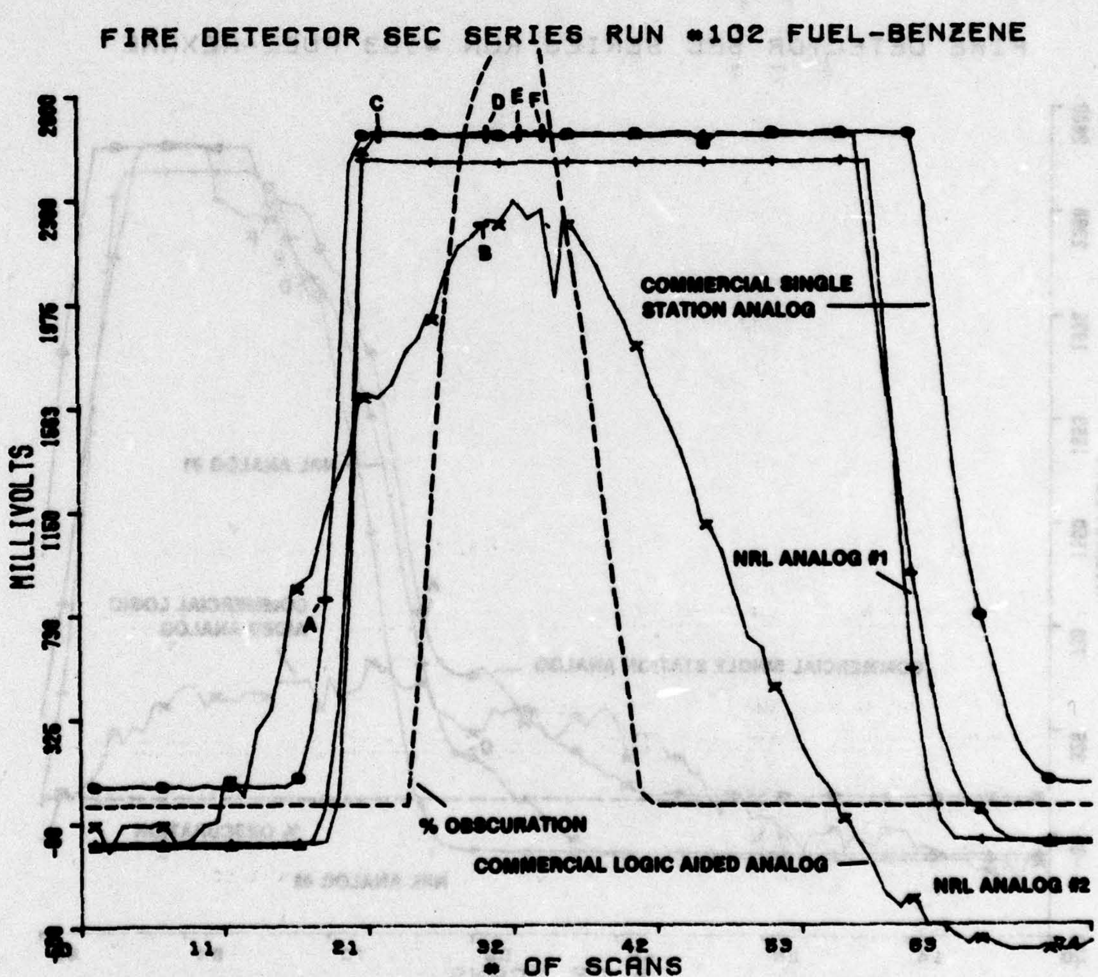
1000 mV=1%/FT
OBSCURATION FULL SCALE =500 mW



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

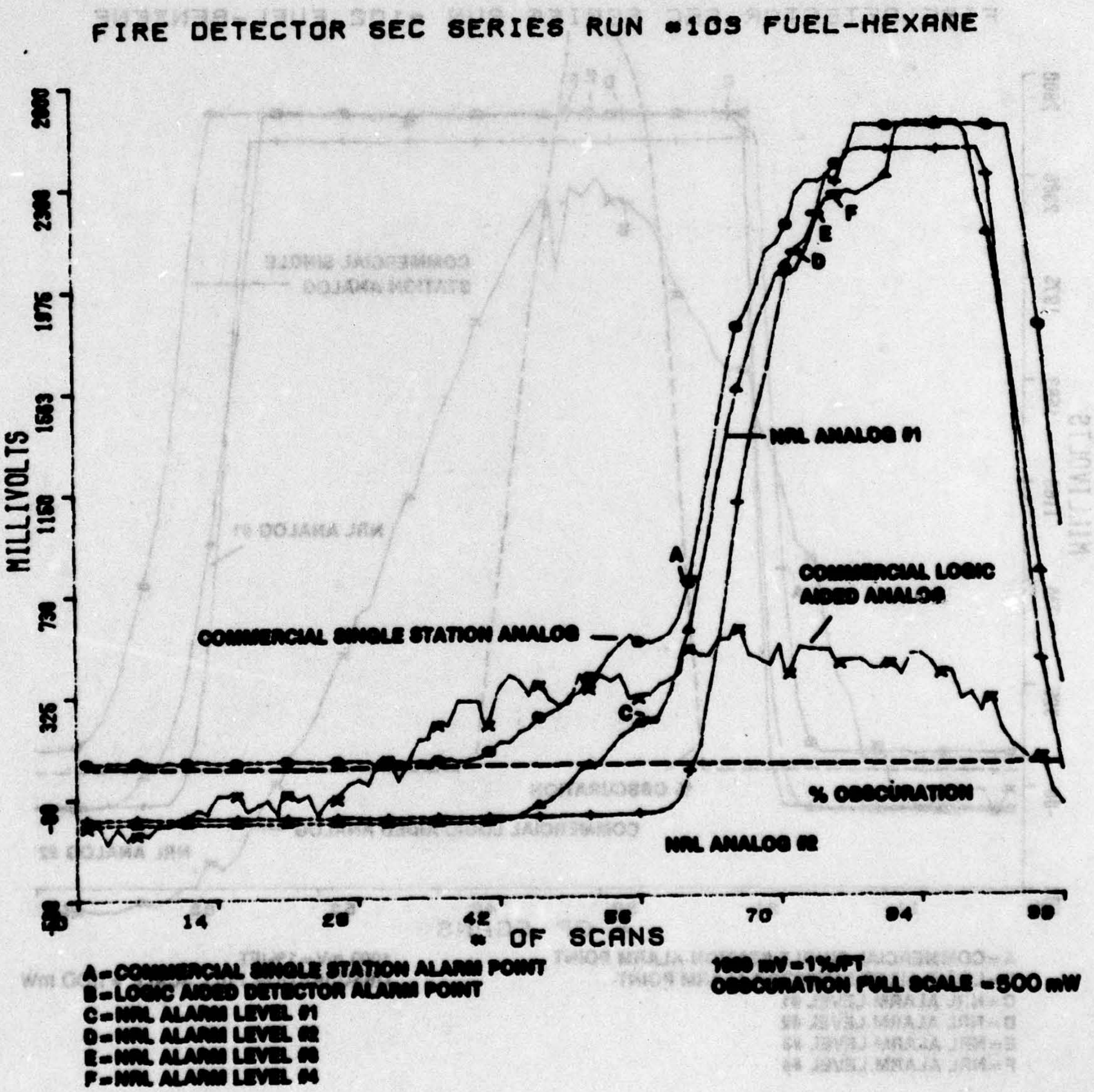
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1250 mW

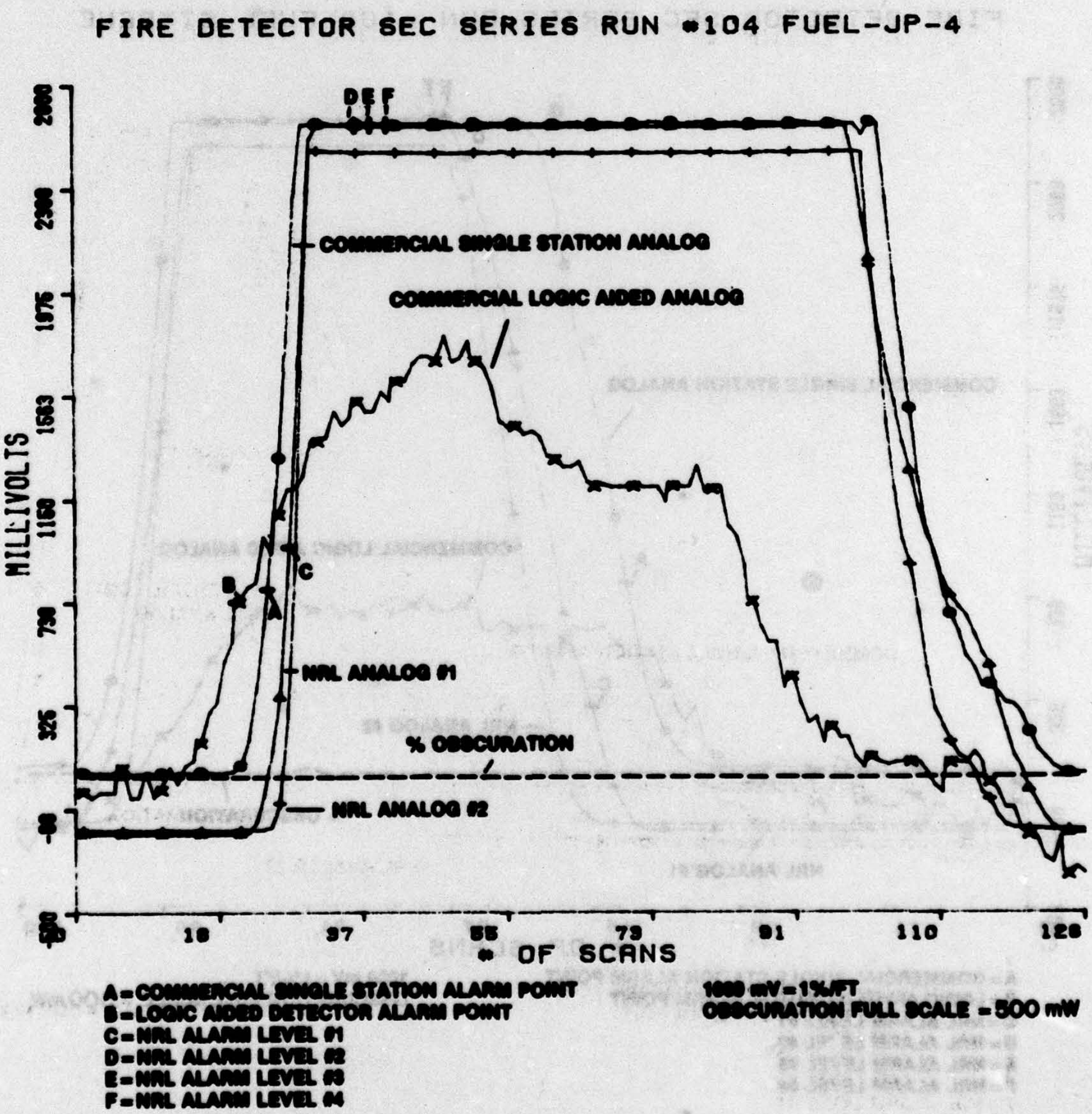

FIRE DETECTOR SEC SERIES RUN #101 FUEL-MEOH
MILLIVOLTS
1000
813
626
438
250
63
-126
-313
-500
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #2
NRL ANALOG #1
COMMERCIAL LOGIC AIDED ANALOG
0
7
13
20
26
33
39
46
OF SCANS
NO ALARM TO THIS FUEL
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW

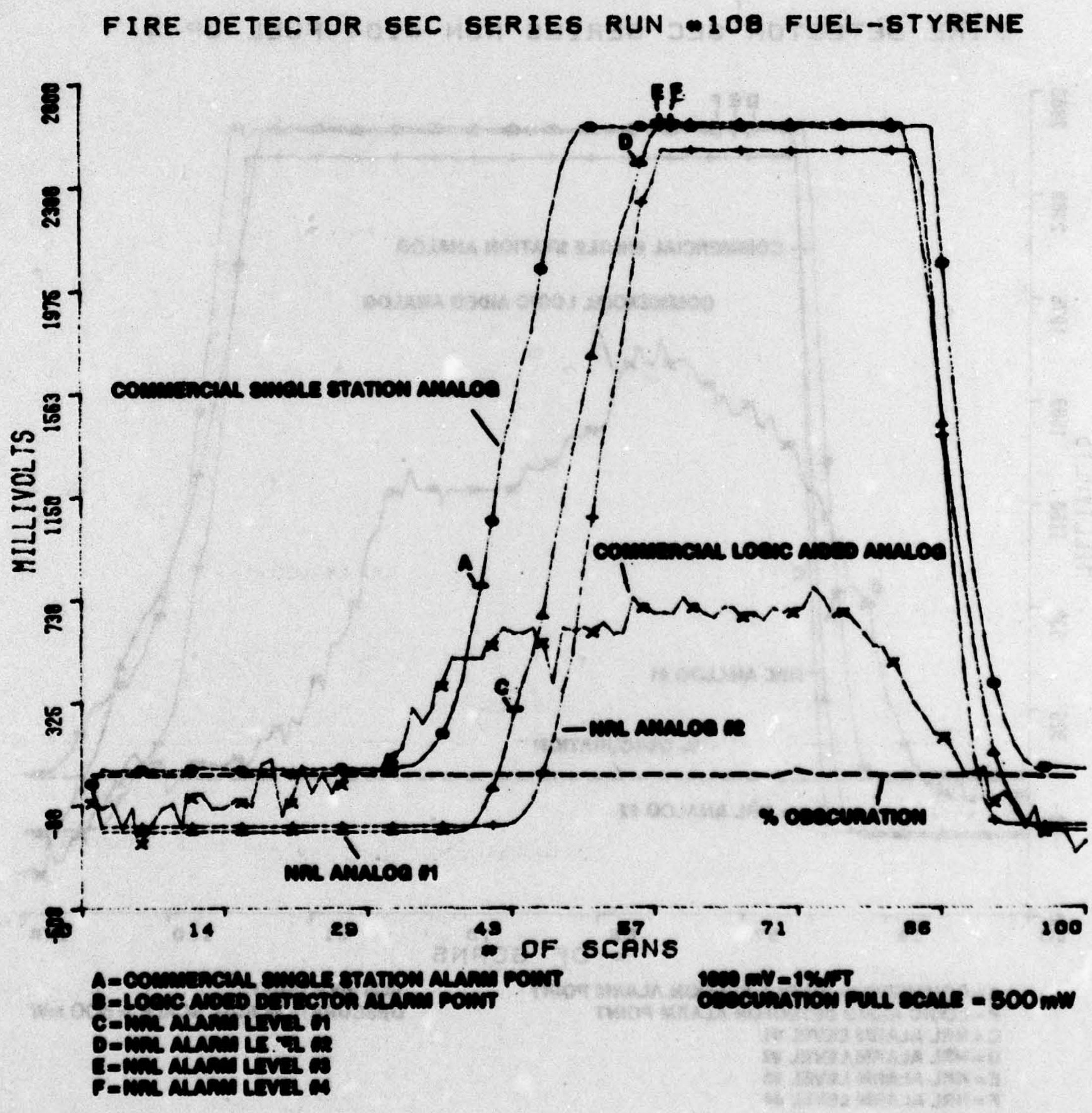


A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

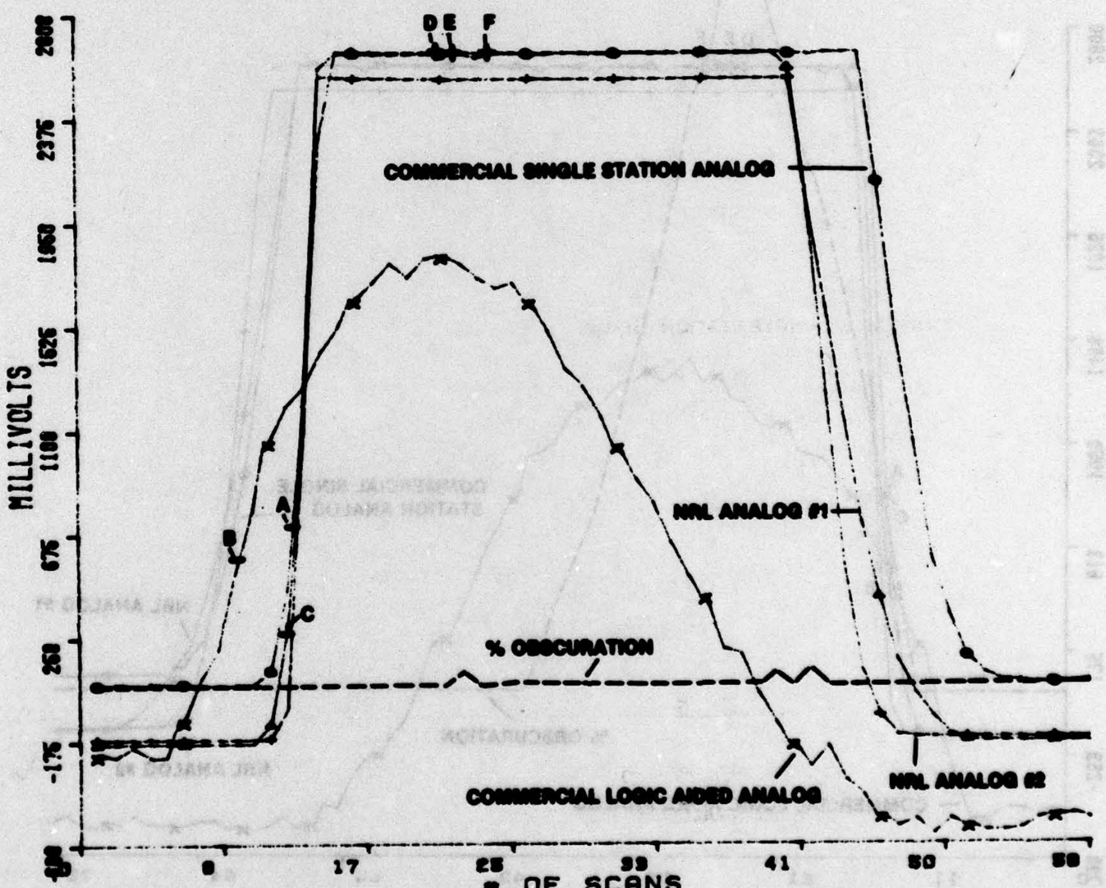
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1100 mW


FIRE DETECTOR SEC SERIES RUN #103 FUEL-HEXANE
MILLIVOLTS
OF SCANS
14
28
42
56
70
84
98
1976
1563
1150
738
326
NRL ANALOG #1
COMMERCIAL LOGIC AIDED ANALOG
COMMERCIAL SINGLE STATION ANALOG
% OBSCURATION
NRL ANALOG #2
A
C
D
E
F
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW


FIRE DETECTOR SEC SERIES RUN #104 FUEL-JP-4
MILLIVOLTS
2600
2200
1975
1563
1150
738
325
-88
-500
0
18
37
55
73
91
110
128
OF SCANS
D E F
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
B
A
C
NRL ANALOG #1
% OBSCURATION
NRL ANALOG #2
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mV

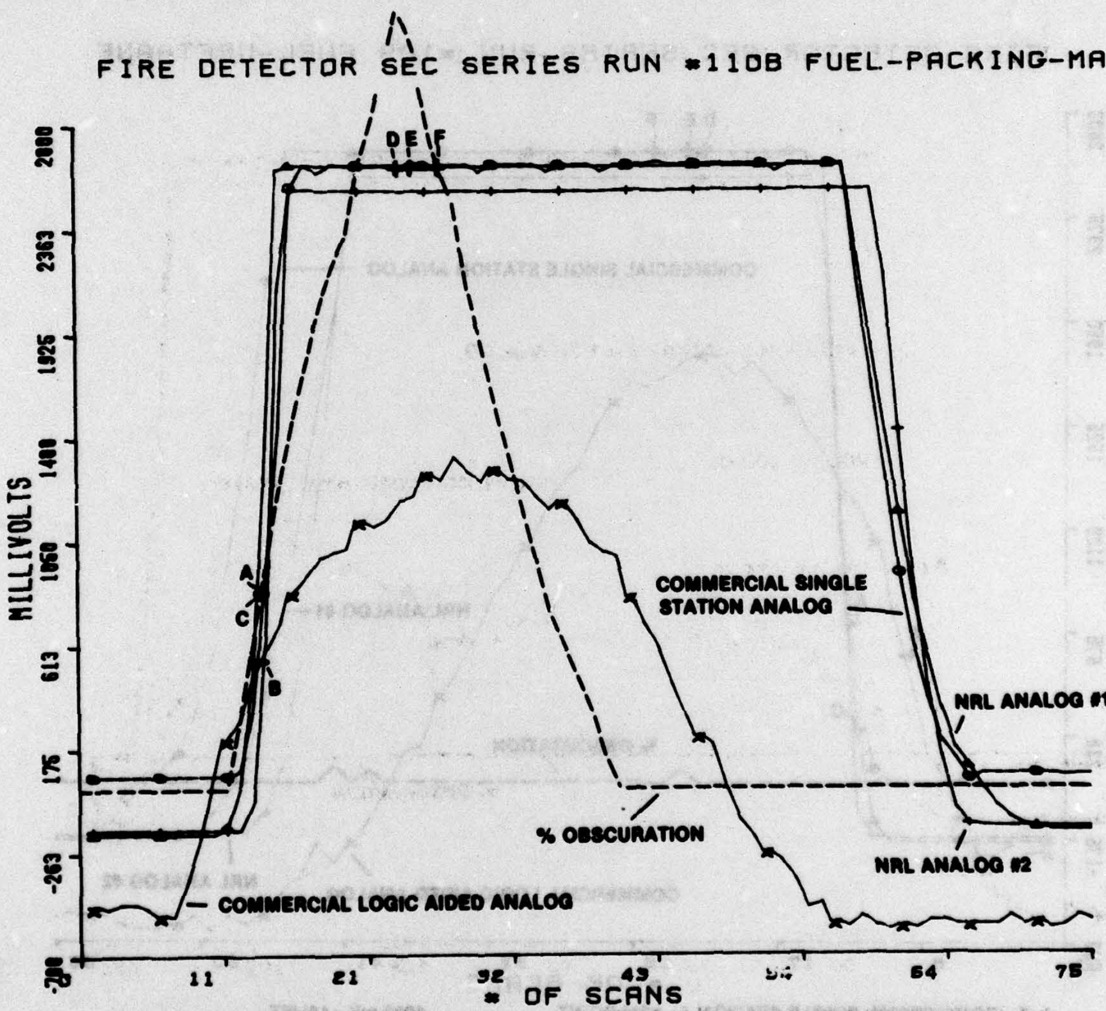

FIRE DETECTOR SEC SERIES RUN #108 FUEL-STYRENE
MILLIVOLTS
2800
2388
1976
1563
1150
738
325
-88
-500
0
14
29
43
57
71
86
100
OF SCANS
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
NRL ANALOG #2
NRL ANALOG #1
% OBSCURATION
A
C
D
E F
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE = 500 mV

FIRE DETECTOR SEC SERIES RUN #109 FUEL-URETHANE



A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4

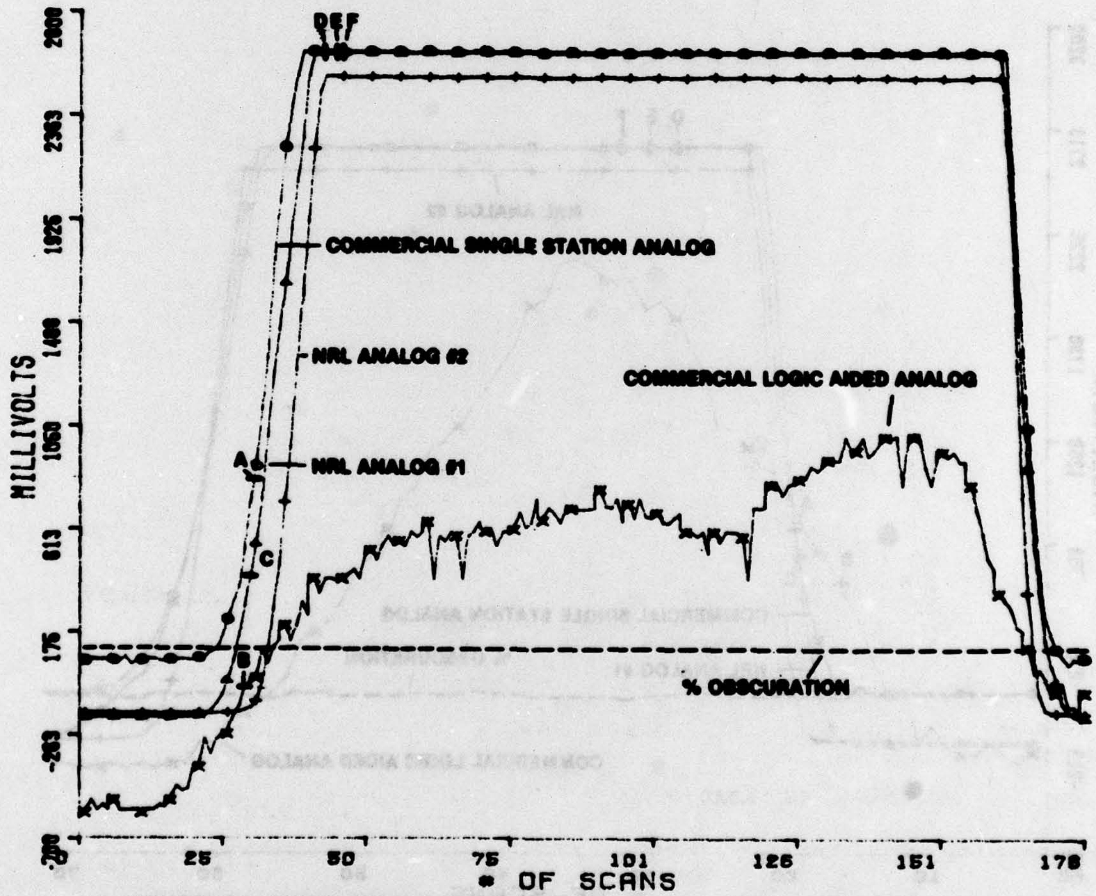
1000 mV=1%/FT
OBSCURATION FULL SCALE = 500 mW



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

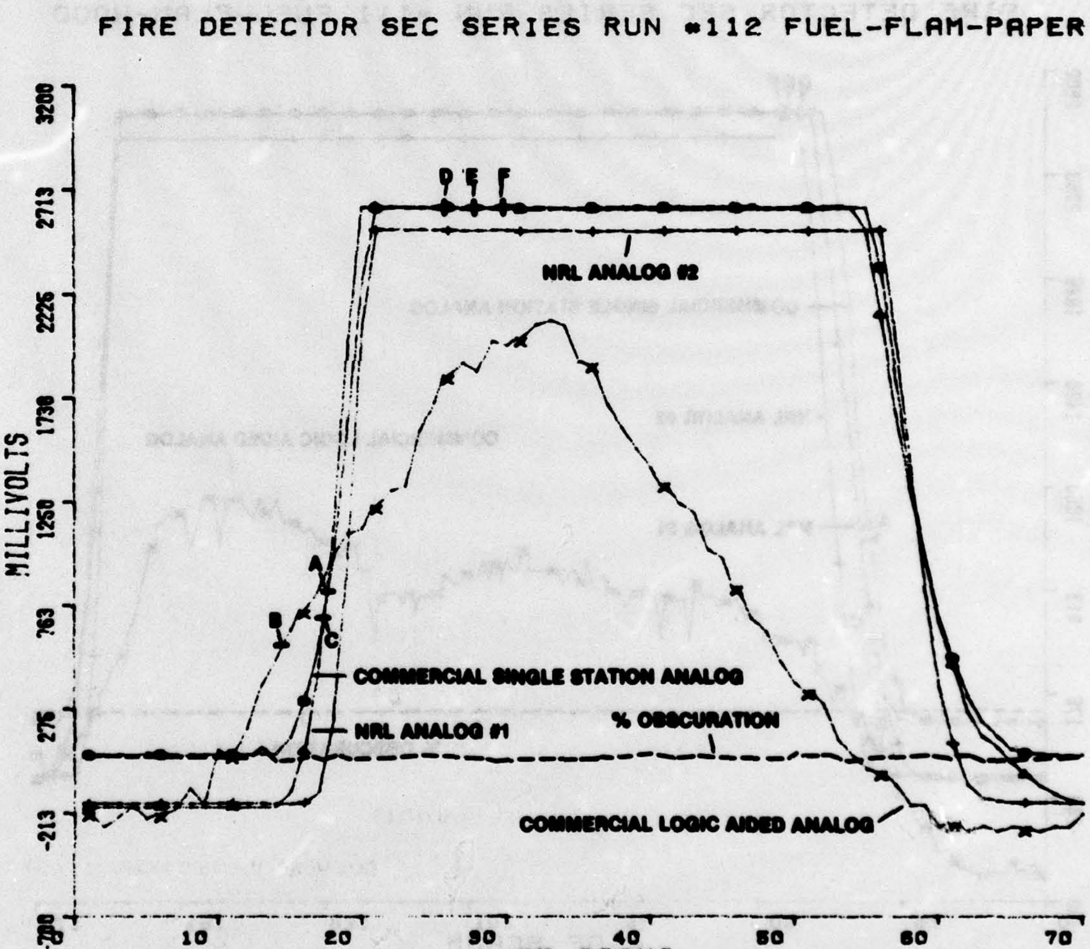
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1200 mW

FIRE DETECTOR SEC SERIES RUN #111 FUEL-FLAM-WOOD



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

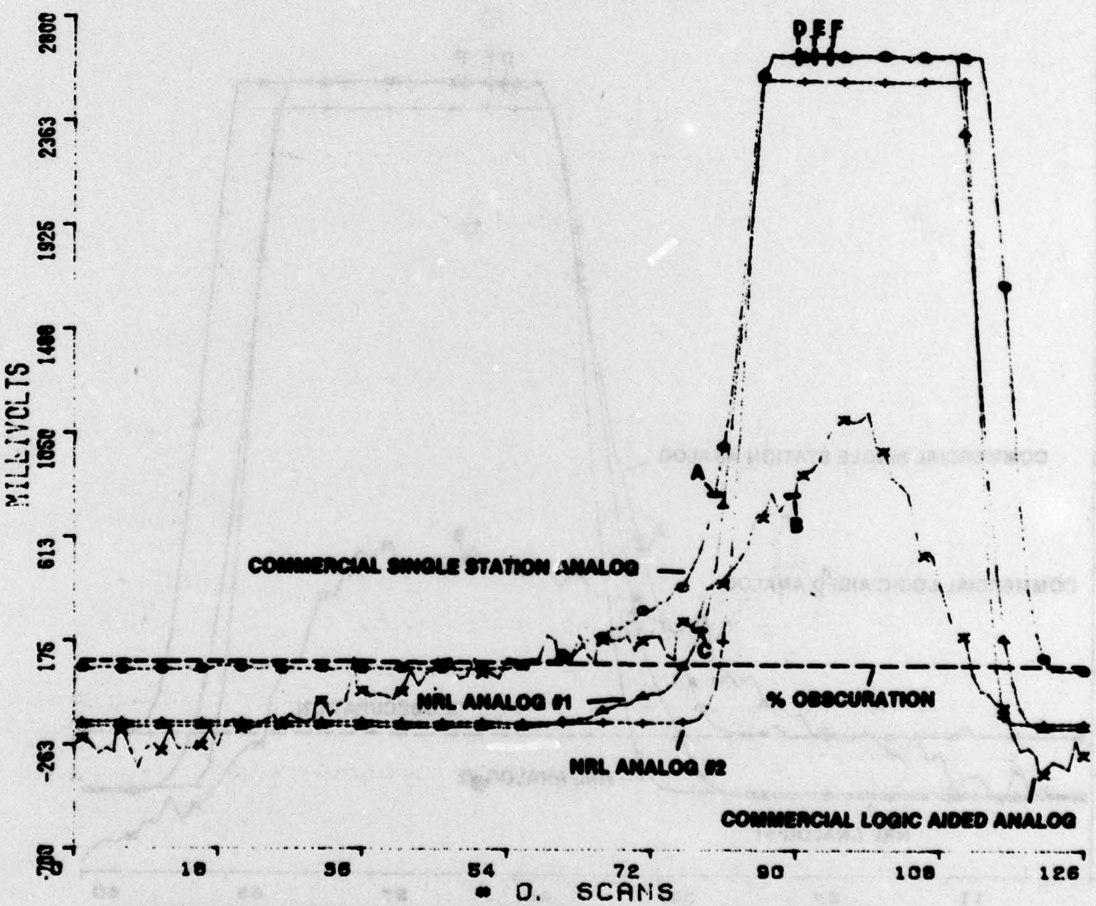
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1000 mW



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 300 mW

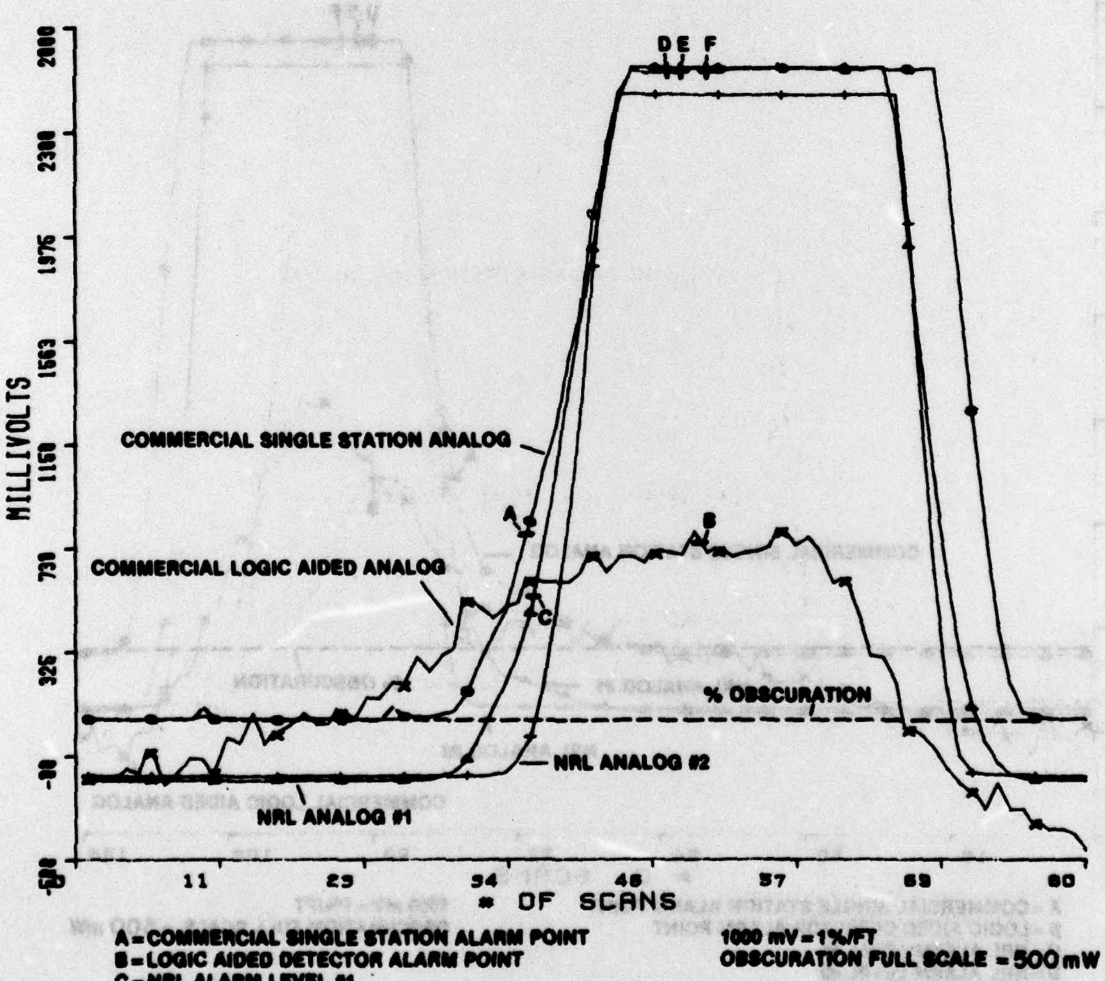
FIRE DETECTOR SEC SERIES RUN #113 FUEL-SMOLD-PAPER



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW

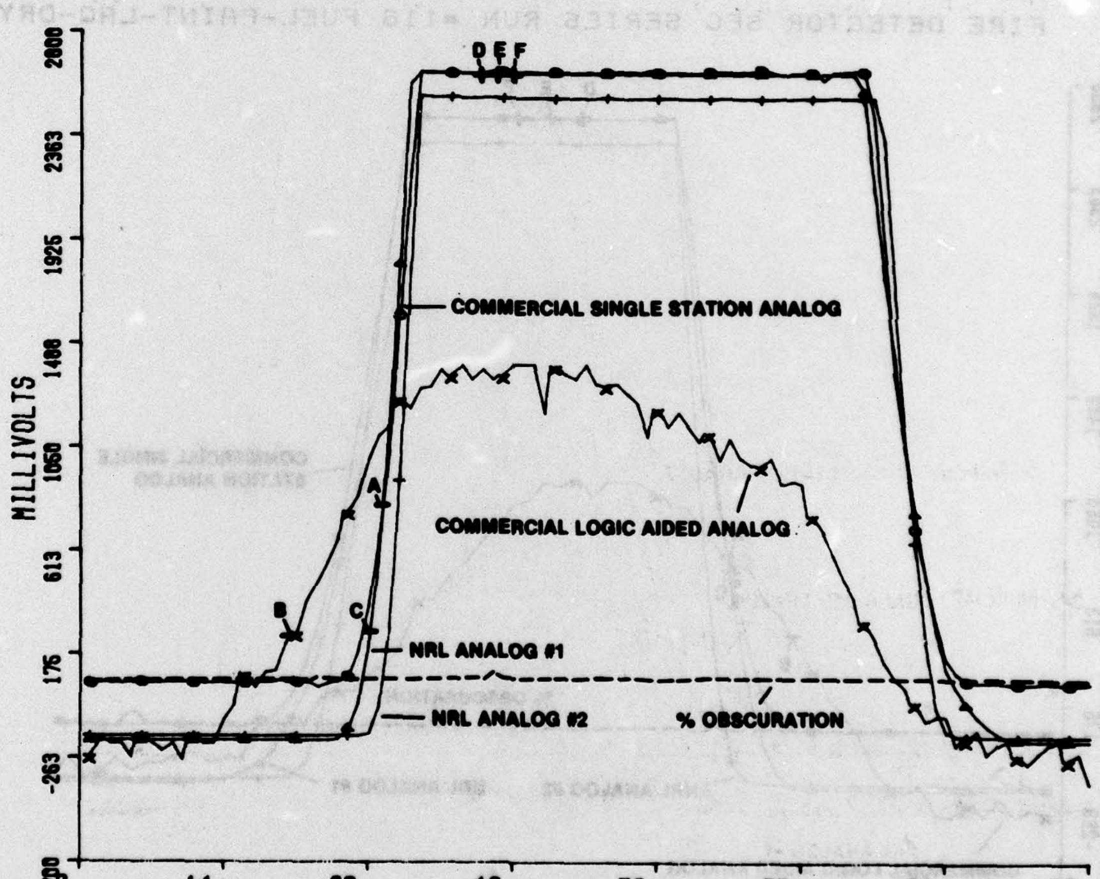
FIRE DETECTOR SEC SERIES RUN #114B FUEL-SMOLD-URETHANE



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

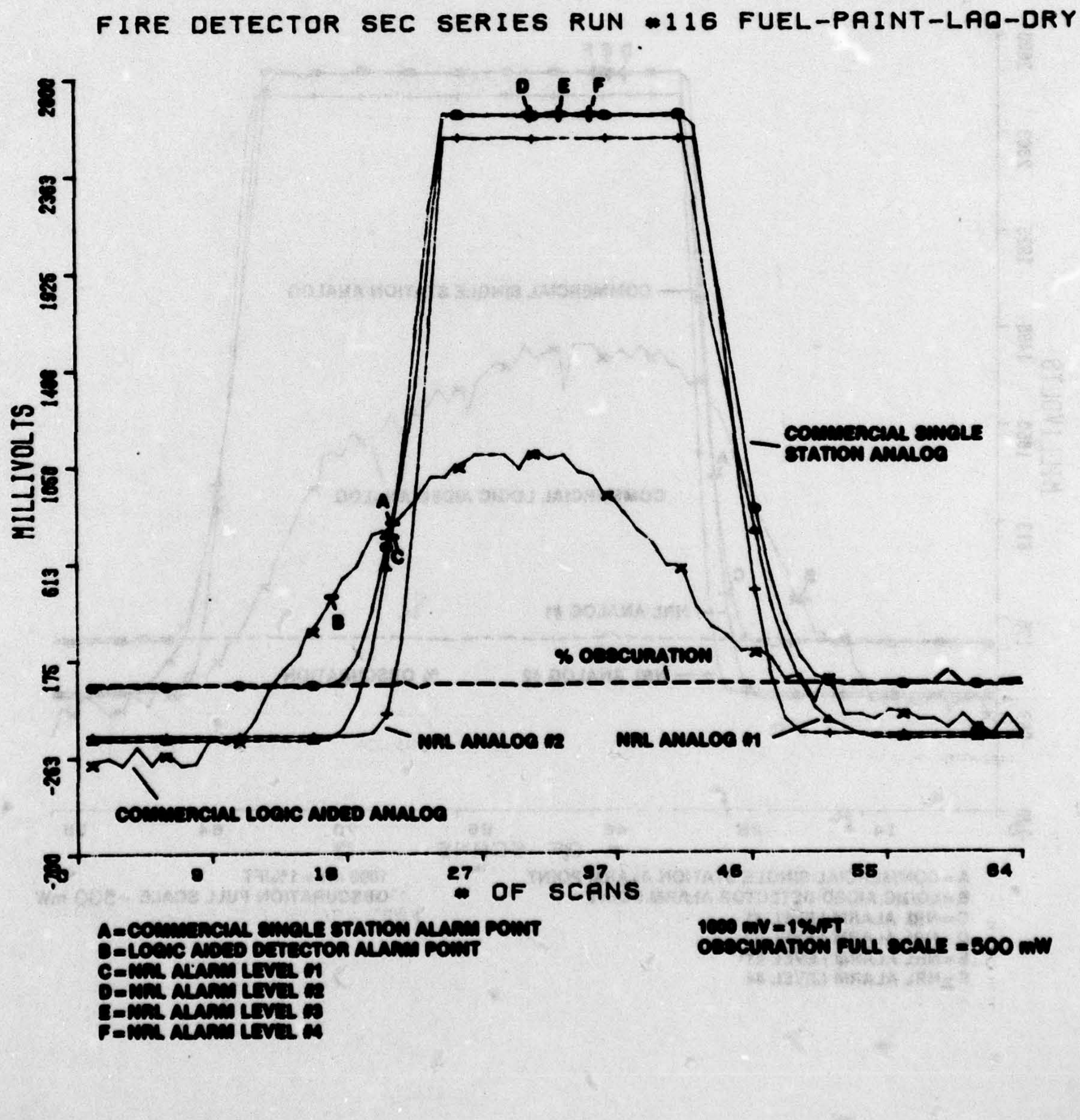
1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW

FIRE DETECTOR SEC SERIES RUN *115 FUEL-MAG-TAPE

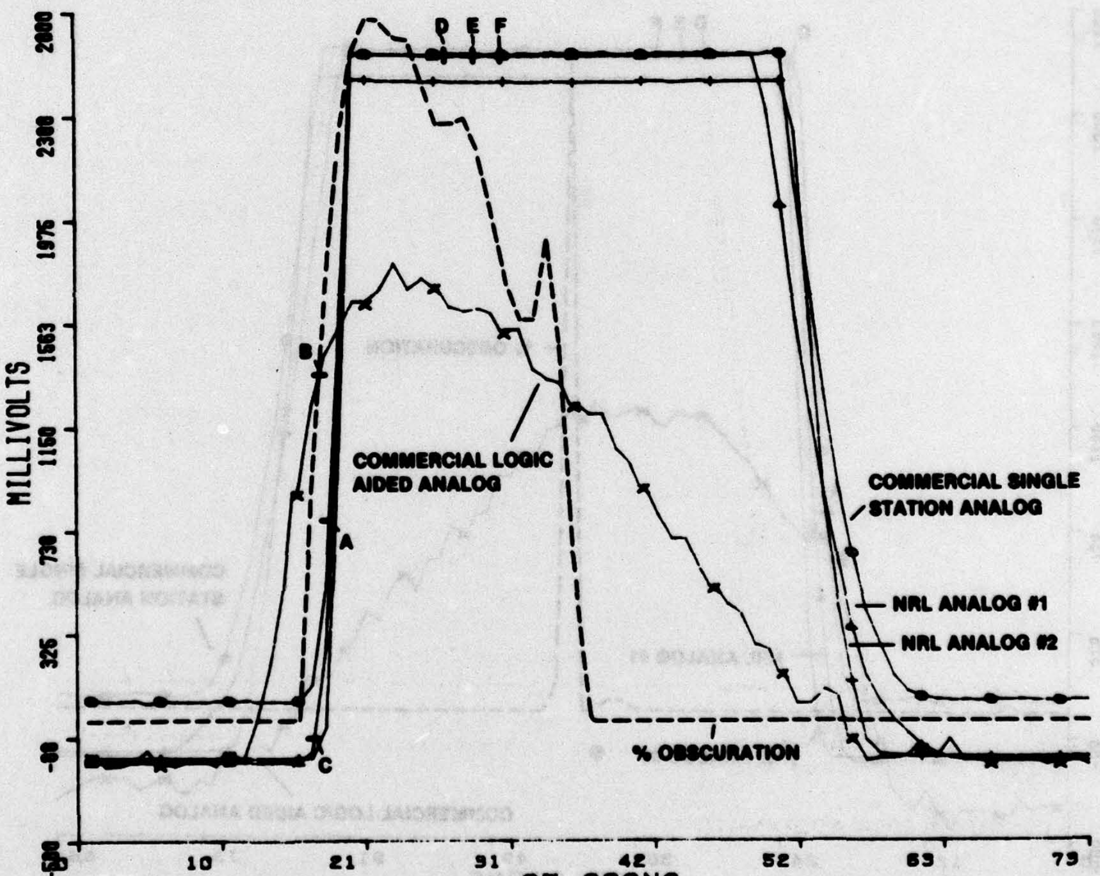


A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 500 mW

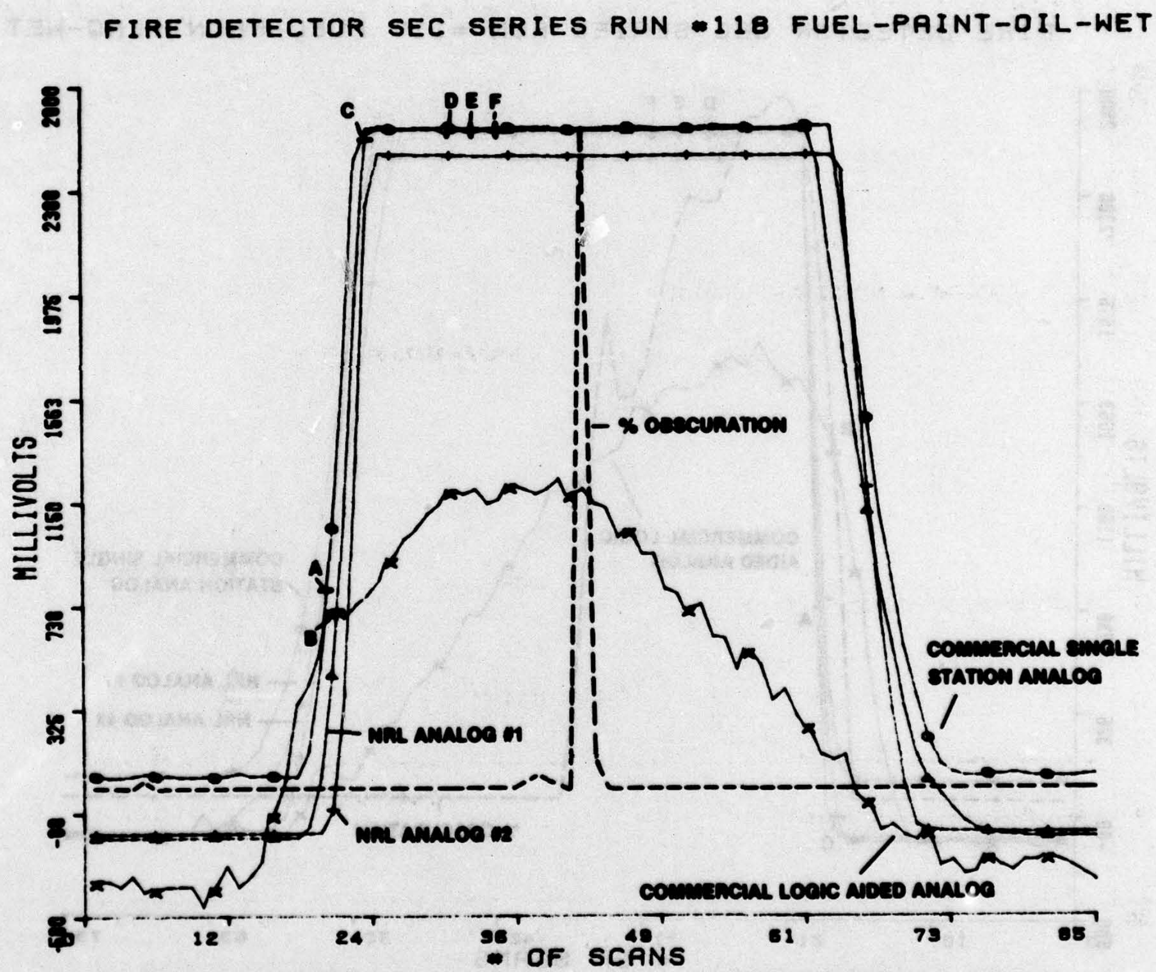

FIRE DETECTOR SEC SERIES RUN #116 FUEL-PAINT-LAQ-DRY
D E F
MILLIVOLTS
2800
2363
1926
1488
1050
613
175
-263
-700
COMMERCIAL SINGLE STATION ANALOG
A
B
C
% OBSCURATION
NRL ANALOG #2
NRL ANALOG #1
COMMERCIAL LOGIC AIDED ANALOG
0
9
18
27
37
46
55
64
# OF SCANS
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE =500 mW

FIRE DETECTOR SEC SERIES RUN #117 FUEL-PAINT-LAQ-WET



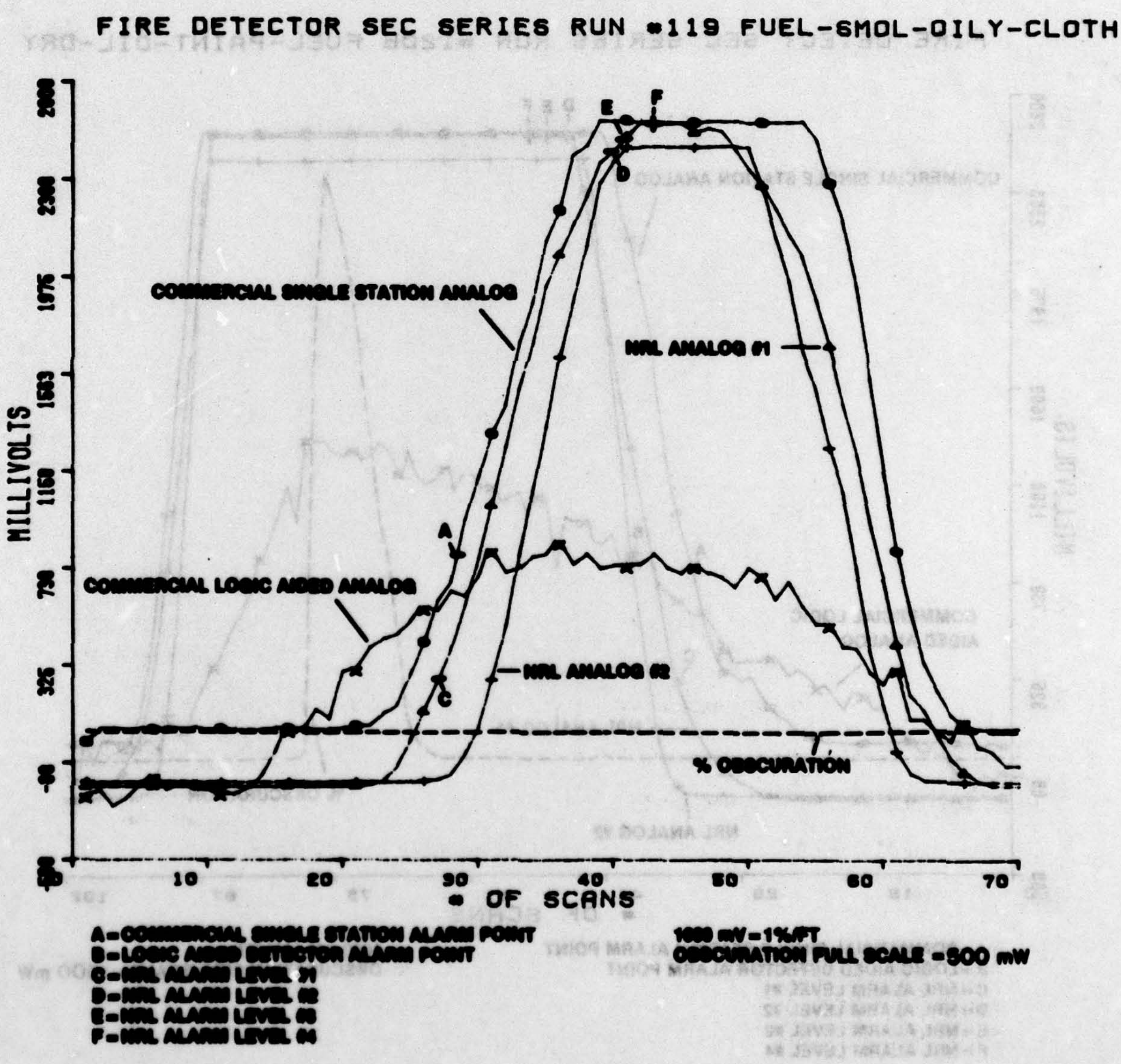
A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 5000 mW

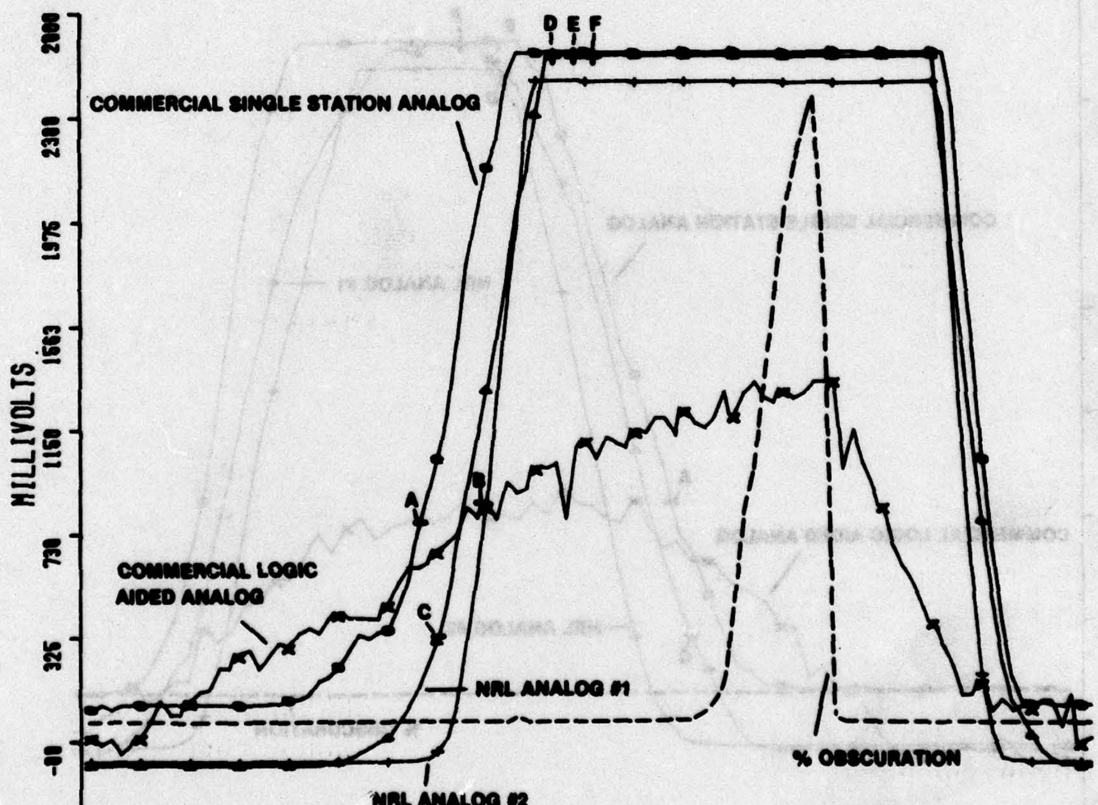


A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1200 mW


FIRE DETECTOR SEC SERIES RUN #119 FUEL-SMOL-OILY-CLOTH
MILLIVOLTS
OF SCANS
10
20
30
40
50
60
70
COMMERCIAL SINGLE STATION ANALOG
COMMERCIAL LOGIC AIDED ANALOG
NRL ANALOG #1
NRL ANALOG #2
% OBSCURATION
A
C
D
E
F
A=COMMERCIAL SINGLE STATION ALARM POINT
B=LOGIC AIDED DETECTOR ALARM POINT
C=NRL ALARM LEVEL #1
D=NRL ALARM LEVEL #2
E=NRL ALARM LEVEL #3
F=NRL ALARM LEVEL #4
1000 mV=1%/FT
OBSCURATION FULL SCALE =500 mW

FIRE DETECT SEC SERIES RUN #120B FUEL-PAINT-OIL-DRY



A = COMMERCIAL SINGLE STATION ALARM POINT
B = LOGIC AIDED DETECTOR ALARM POINT
C = NRL ALARM LEVEL #1
D = NRL ALARM LEVEL #2
E = NRL ALARM LEVEL #3
F = NRL ALARM LEVEL #4

1000 mV = 1%/FT
OBSCURATION FULL SCALE = 1500 mW